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(54) HETEROCYCLIC INHIBITORS OF P38

HETEROCYCLISCHE INHIBITOREN VON P38

INHIBITEURS HETEROCYCLIQUES DE LA PROTEINE P38

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01.04.1999 US 127626 P
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(56) References cited:
EP-A- 0 337 943 **EP-A- 0 337 944**
WO-A-97/33883 **WO-A-98/27098**

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DescriptionTECHNICAL FIELD OF INVENTION

5 [0001] The present invention relates to inhibitors of p38, a mammalian protein kinase involved in cell proliferation, cell death and response to extracellular stimuli. The invention also relates to methods for producing these inhibitors. The invention also provides pharmaceutical compositions comprising the inhibitors of the invention and methods of utilizing those compositions in the treatment and prevention of various disorders.

10 BACKGROUND OF THE INVENTION

15 [0002] Protein kinases are involved in various cellular responses to extracellular signals. Recently, a family of mitogen-activated protein kinases (MAPK) has been discovered. Members of this family are Ser/Thr kinases that activate their substrates by phosphorylation [B. Stein et al., Ann. Rep. Med. Chem., 31, pp. 289-98 (1996)]. MAPKs are themselves activated by a variety of signals including growth factors, cytokines, UV radiation, and stress-inducing agents.

20 [0003] One particularly interesting MAPK is p38. p38, also known as cytokine suppressive anti-inflammatory drug binding protein (CSBP) and RK, was isolated from murine pre-B cells that were transfected with the lipopolysaccharide (LPS) receptor, CD14, and induced with LPS. p38 has since been isolated and sequenced, as has the cDNA encoding it in humans and mouse. Activation of p38 has been observed in cells stimulated by stress, such as treatment of lipopolysaccharides (LPS), UV, anisomycin, or osmotic shock, and by cytokines, such as IL-1 and TNF.

25 [0004] Inhibition of p38 kinase leads to a blockade on the production of both IL-1 and TNF. IL-1 and TNF stimulate the production of other proinflammatory cytokines such as IL-6 and IL-8 and have been implicated in acute and chronic inflammatory diseases and in postmenopausal osteoporosis [R. B. Kimble et al., Endocrinol., 136, pp. 3054-61 (1995)].

30 [0005] Based upon this finding, it is believed that p38, along with other MAPKs, have a role in mediating cellular response to inflammatory stimuli, such as leukocyte accumulation, macrophage/monocyte activation, tissue resorption, fever, acute phase responses and neutrophilia. In addition, MAPKs, such as p38, have been implicated in cancer, thrombin-induced platelet aggregation, immunodeficiency disorders, autoimmune diseases, cell death, allergies, osteoporosis and neurodegenerative disorders. Inhibitors of p38 have also been implicated in the area of pain management through inhibition of prostaglandin endoperoxide synthase-2 induction. Other diseases associated with IL-1, IL-6, IL-8 or TNF overproduction are set forth in WO 96/21654.

35 [0006] PCT publication WO 97/33883 describes amino-substituted pyrimidine compounds for use in treating cytokine mediated diseases. European Patent Applications EP 0 337 943 and EP 0 337 944 describe N-phenyl-N-pyrimidin-2-yl ureas having herbicidal and plant growth-regulating activity.

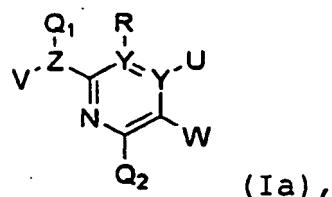
40 [0007] Others have already begun trying to develop drugs that specifically inhibit MAPKs. For example, PCT publication WO 95/31451 describes pyrazole compounds that inhibit MAPKs, and, in particular, p38. However, the efficacy of these inhibitors *in vivo* is still being investigated. PCT publication WO 98/27098 also describes p38 inhibitors, which include substituted pyridine compounds.

45 [0008] Accordingly, there is still a great need to develop other potent inhibitors of p38, including p38-specific inhibitors, that are useful in treating various conditions associated with p38 activation.

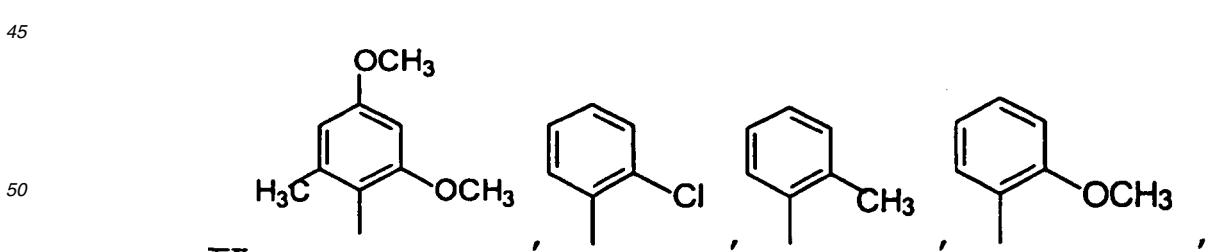
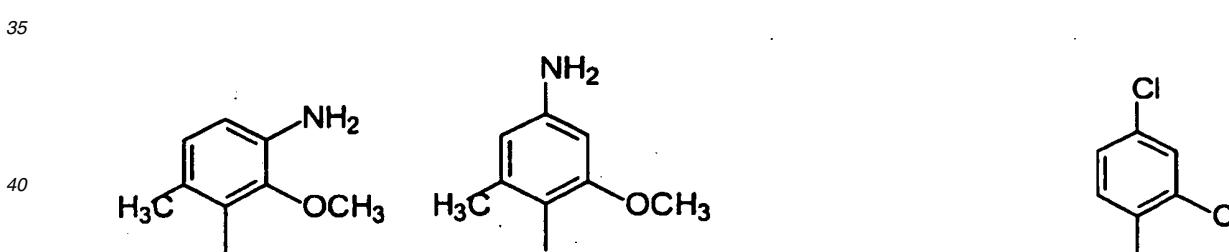
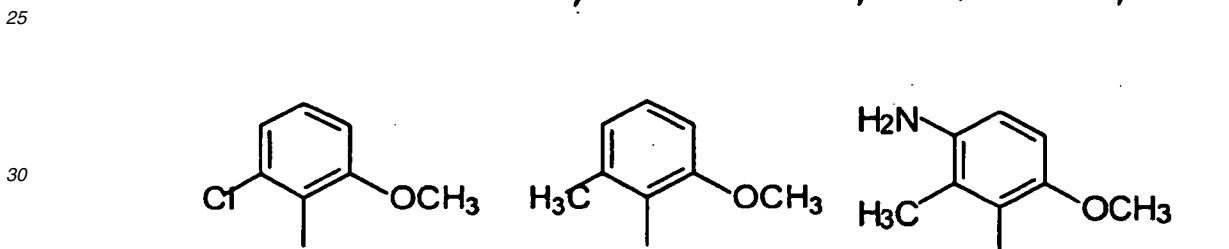
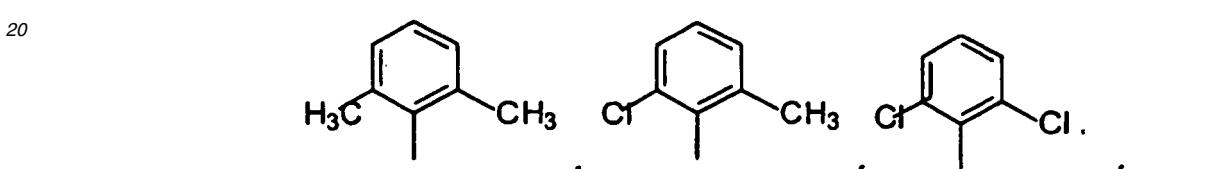
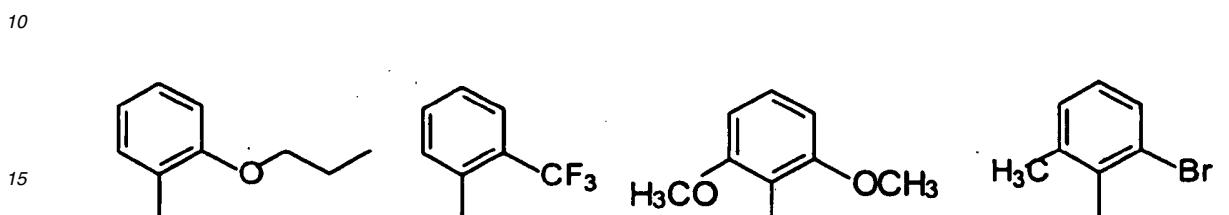
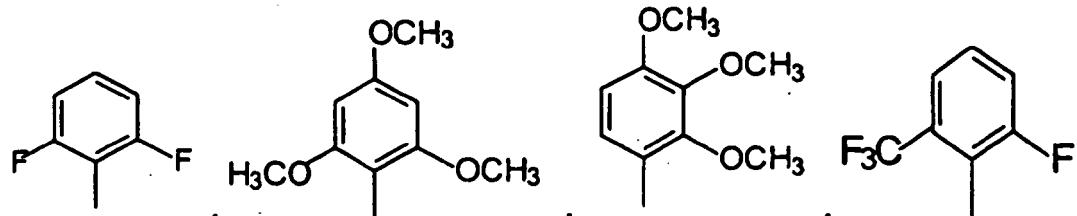
SUMMARY OF THE INVENTION

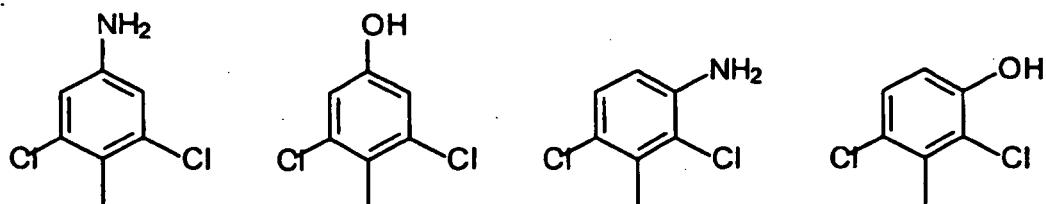
50 [0009] The present invention addresses this problem by providing compounds that demonstrate strong inhibition of p38.

[0010] These compounds have the general formula:

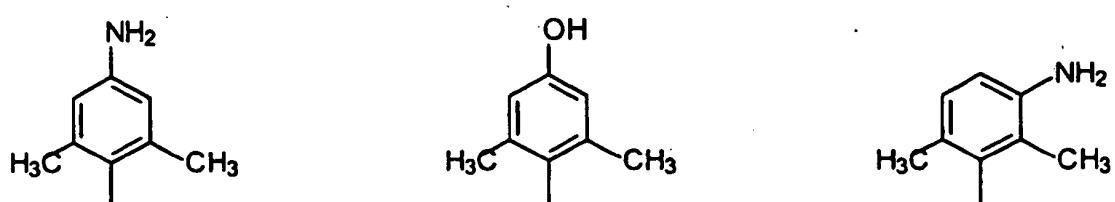


55 wherein Q₁ is selected from:

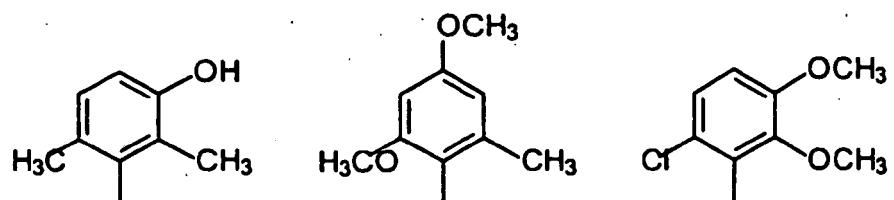




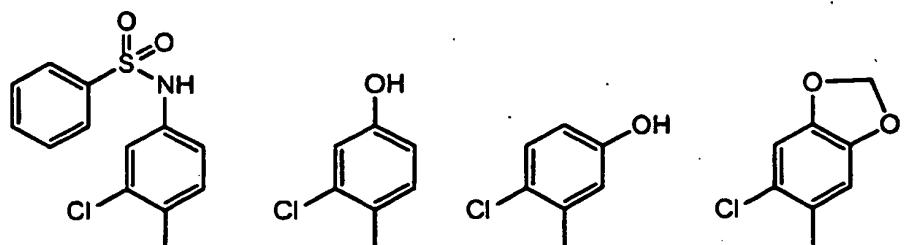
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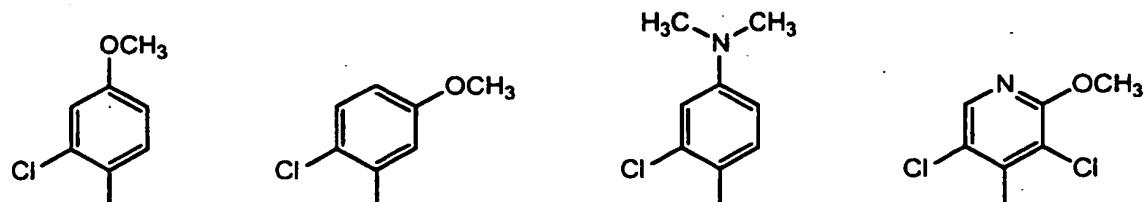
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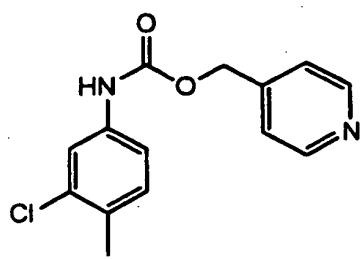
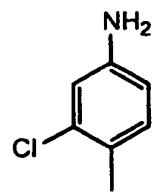
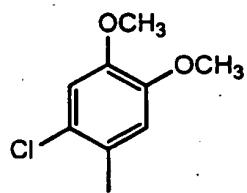


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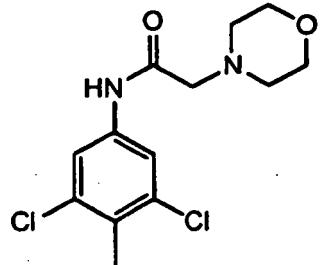
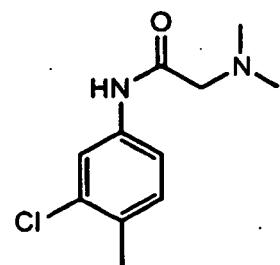
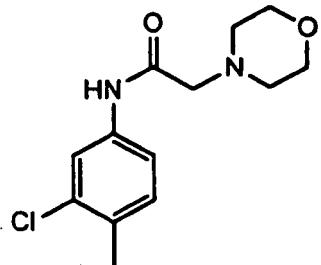
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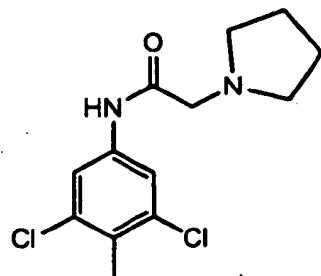
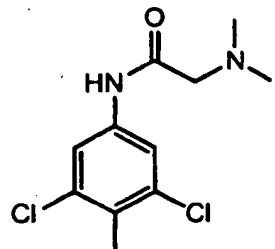
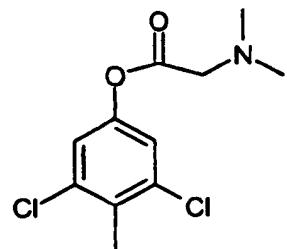
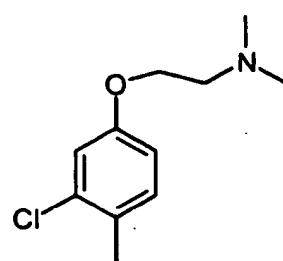
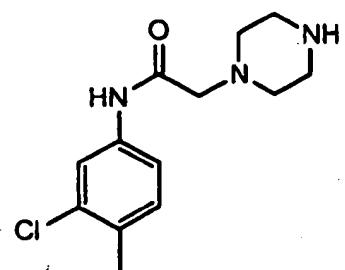
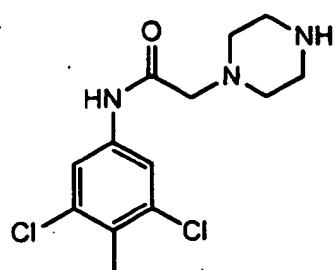
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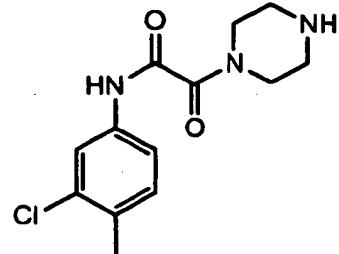
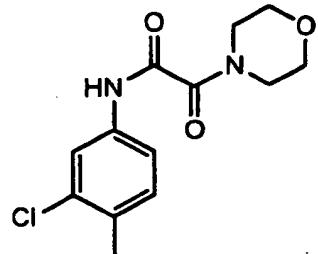
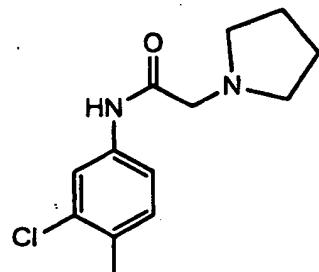


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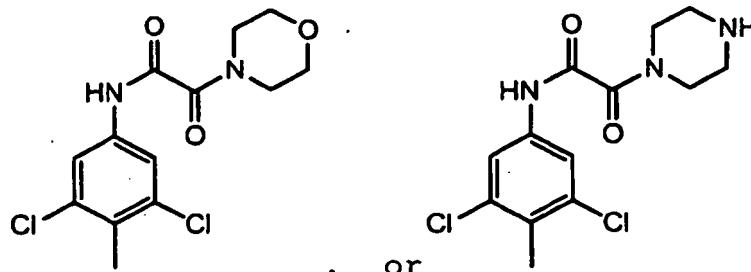


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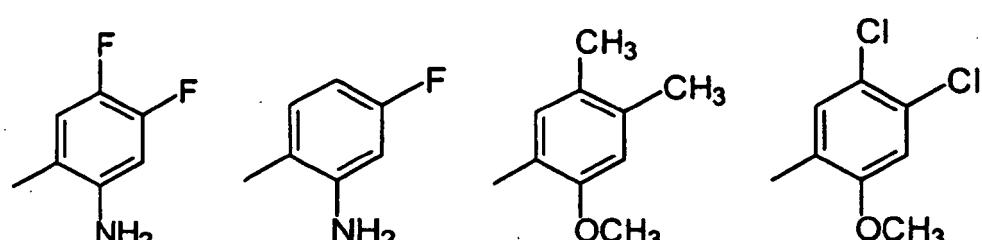
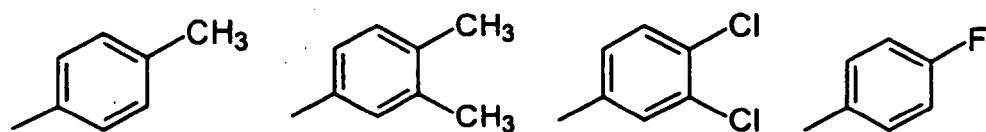
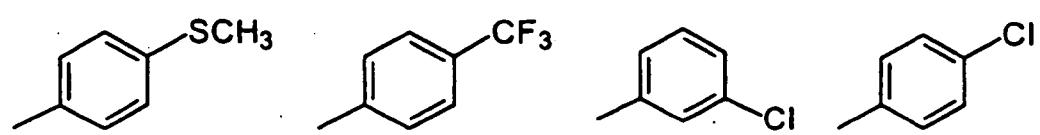
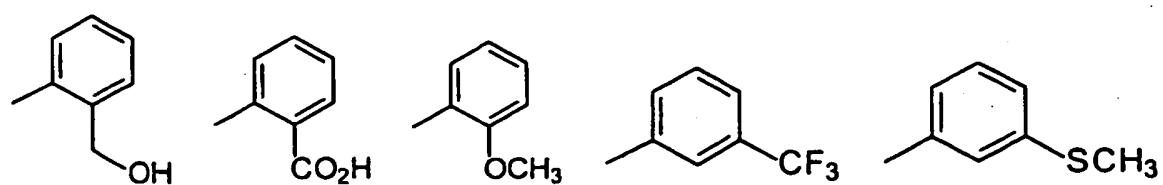


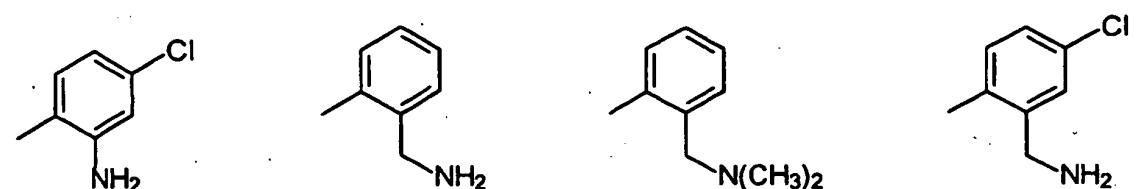
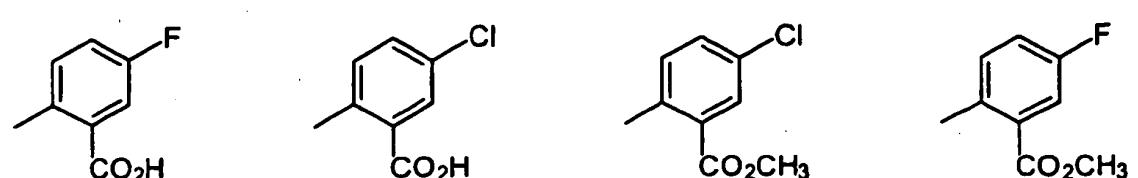
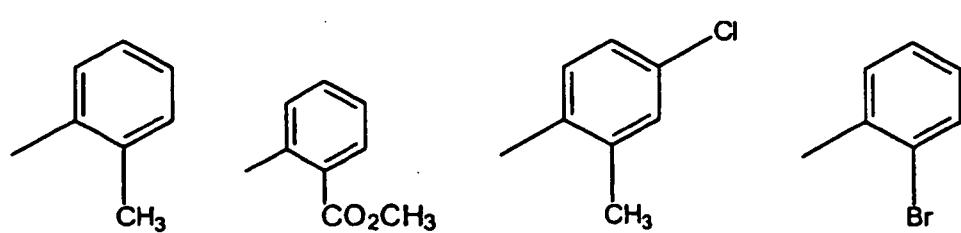
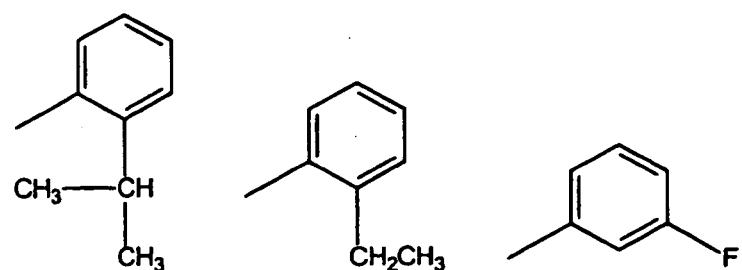
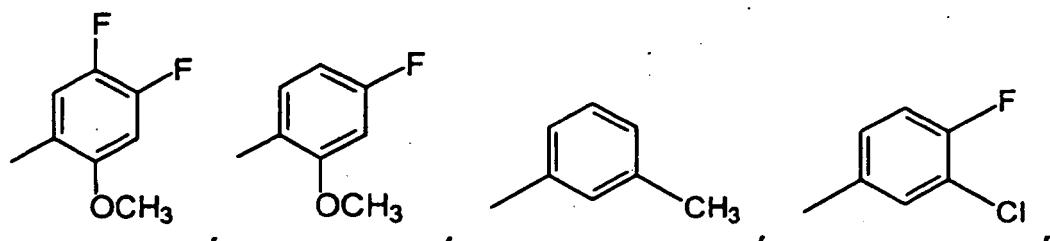
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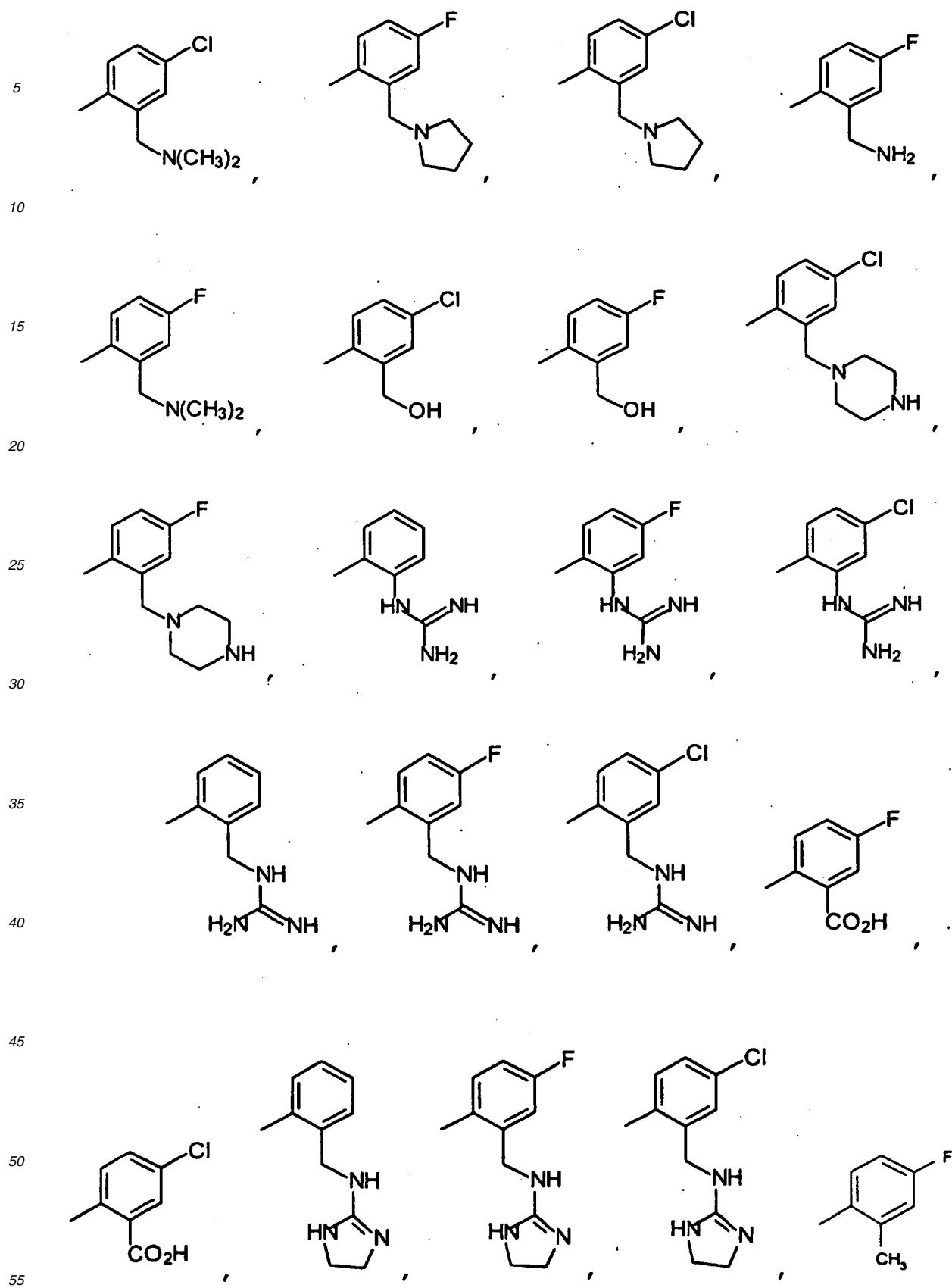
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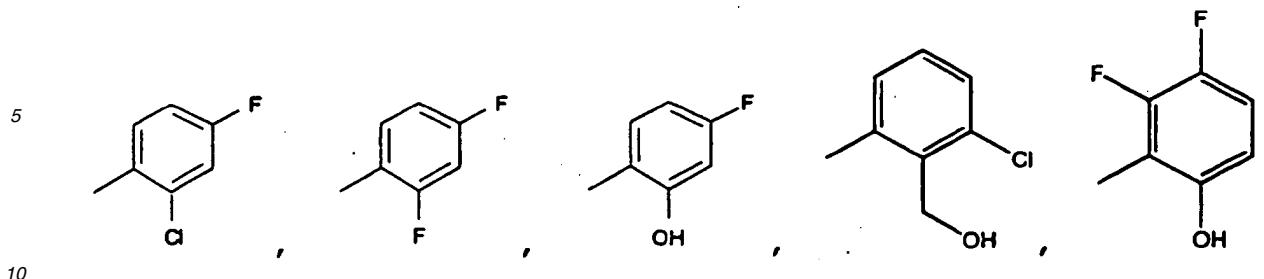


Q₂ is selected from:









unsubstituted 2-pyridyl or unsubstituted phenyl;

15 R' is selected from hydrogen; (C₁-C₃)-alkyl; (C₂-C₃)-alkenyl or alkynyl; phenyl or phenyl substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl; or a 5-6 membered heterocyclic ring system optionally substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl;

20 R³ is selected from 5-8 membered aromatic or non-aromatic carbocyclic or heterocyclic ring systems;

25 W is selected from N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; N(R²)₂; C(O)-R²; CH(OH)-R²; C(O)-N(R²)₂; C(O)-OR²; or (C₁-C₄) straight or branched alkyl optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, R³, or SO₂N(R²)₂; or a 5-6 membered carbocyclic or heterocyclic ring system optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, or SO₂N(R²)₂; provided that W is not an R³ substituted C₁ alkyl;

30 R² is selected from hydrogen, (C₁-C₃)-alkyl, or (C₁-C₃)-alkenyl; each optionally substituted with -N(R')₂, -OR', SR', -C(O)-N(R')₂, -S(O₂)-N(R')₂, -C(O)-OR';

35 each Y is C, wherein each R and U attached to Y is independently selected from hydrogen or methyl;

Z is CH or N; and

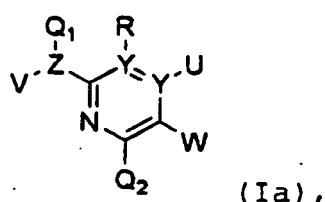
V is -C(O)NH₂.

[0011] In another embodiment, the invention provides pharmaceutical compositions comprising the p38 inhibitors of this invention. These compositions may be utilized in methods for treating or preventing a variety of disorders, such as cancer, inflammatory diseases, autoimmune diseases, destructive bone disorders, proliferative disorders, infectious diseases, viral diseases and neurodegenerative diseases. These compositions are also useful in methods for preventing cell death and hyperplasia and therefore may be used to treat or prevent reperfusion/ischemia in stroke, heart attacks, and organ hypoxia. The compositions are also useful in methods for preventing thrombin-induced platelet aggregation.

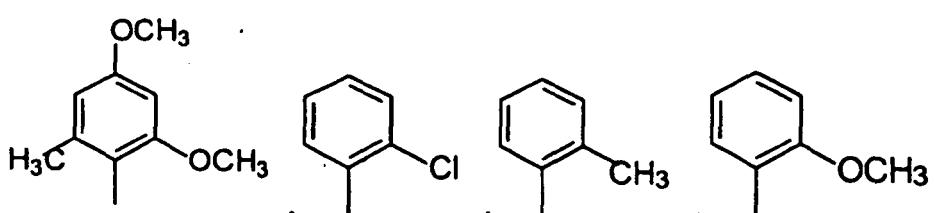
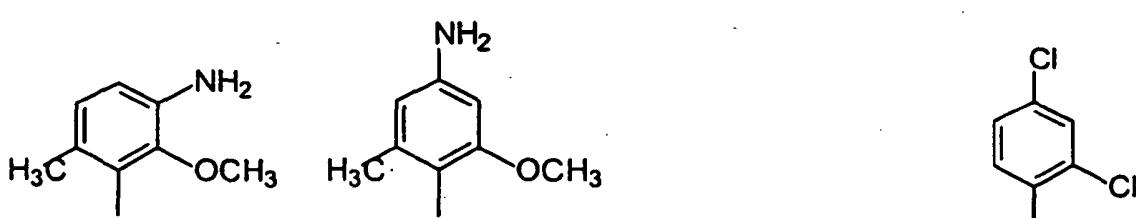
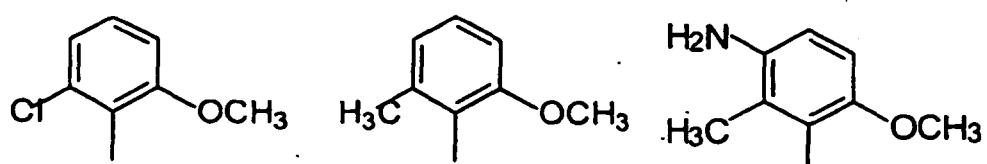
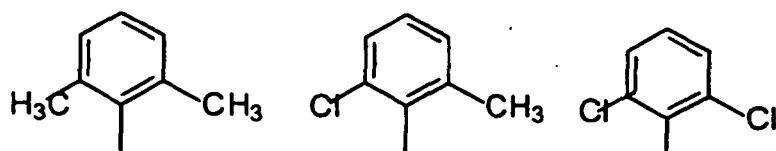
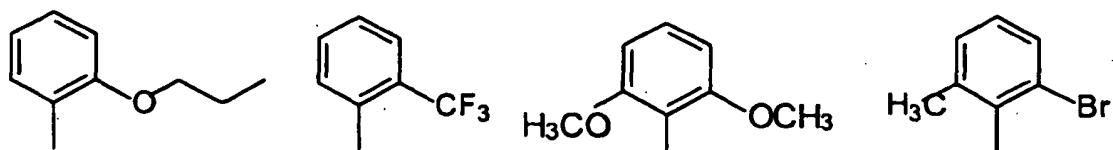
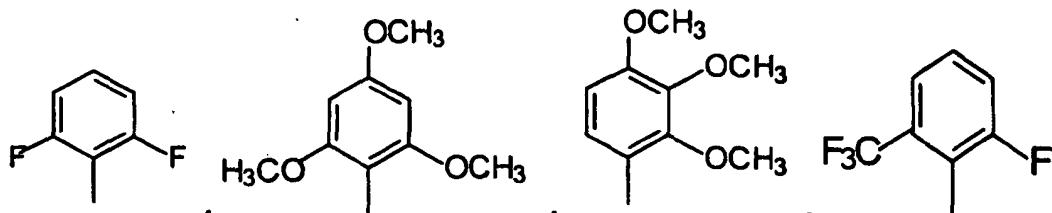
35 Each of these above-described methods is also part of the present invention.

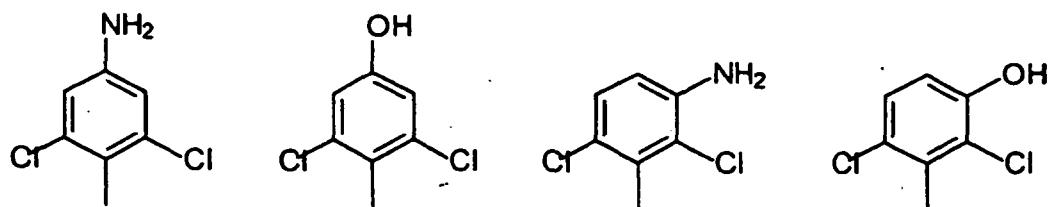
DETAILED DESCRIPTION OF THE INVENTION

[0012] These compounds have the general formula:

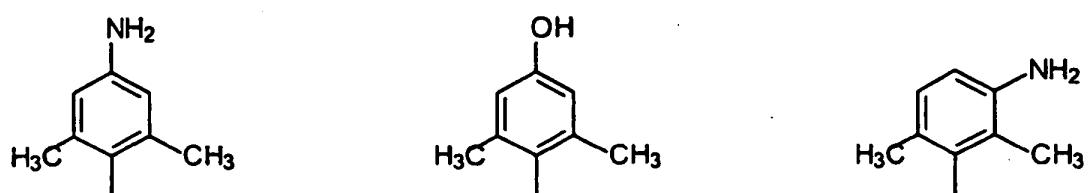


50 wherein Q₁ is selected from:

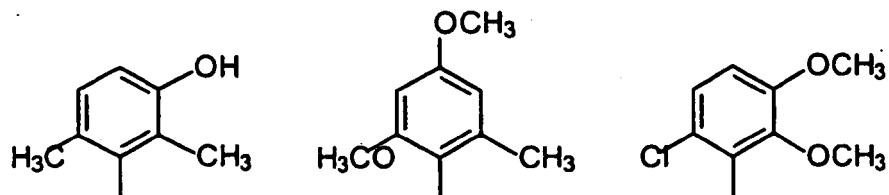




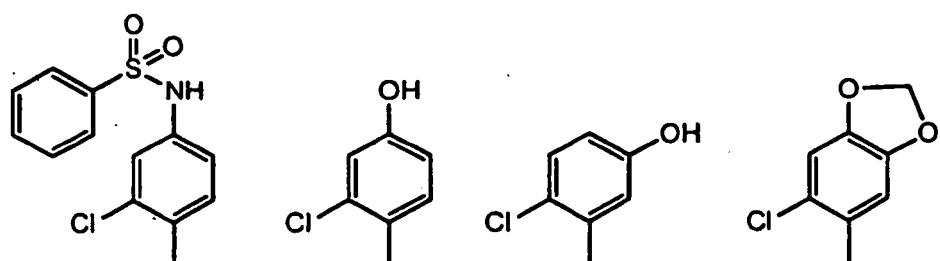
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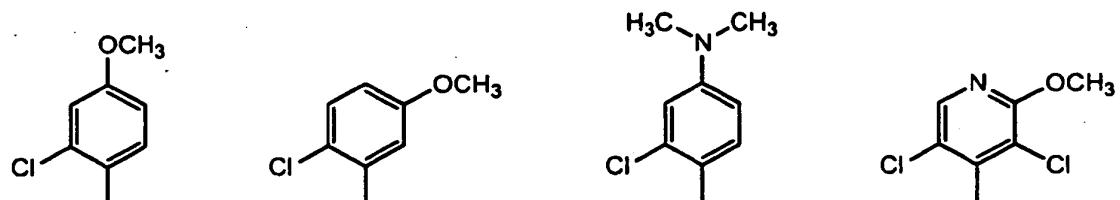
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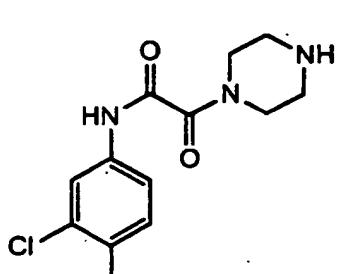
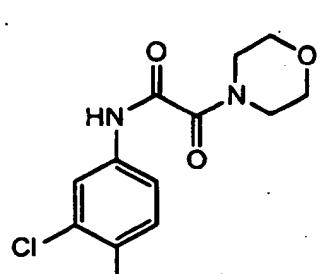
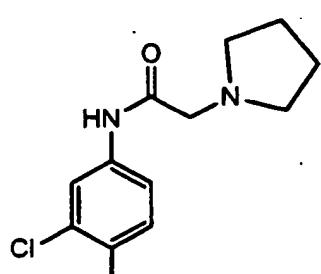
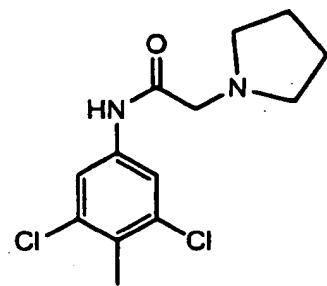
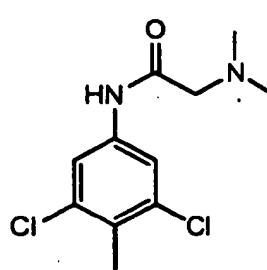
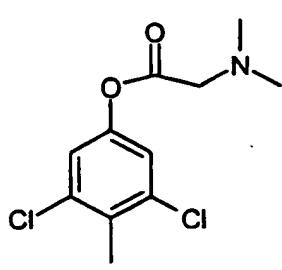
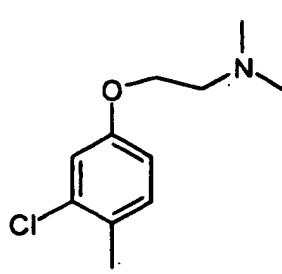
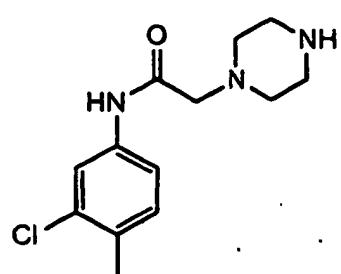
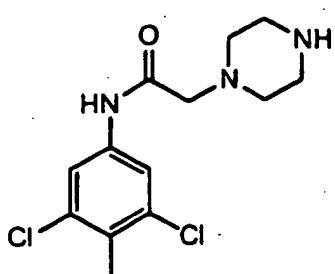
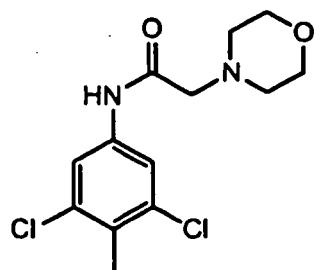
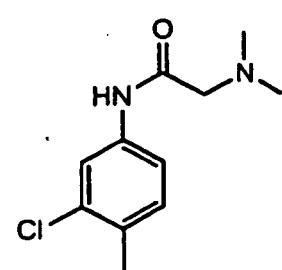
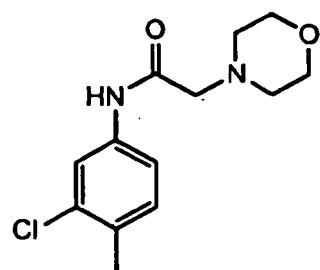
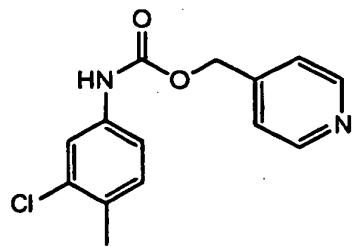
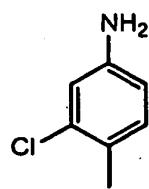
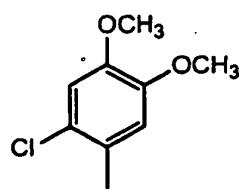


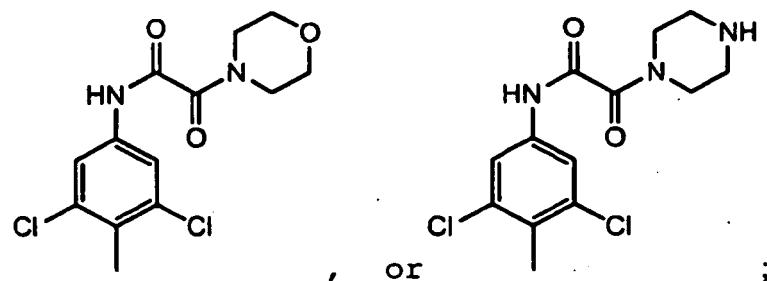
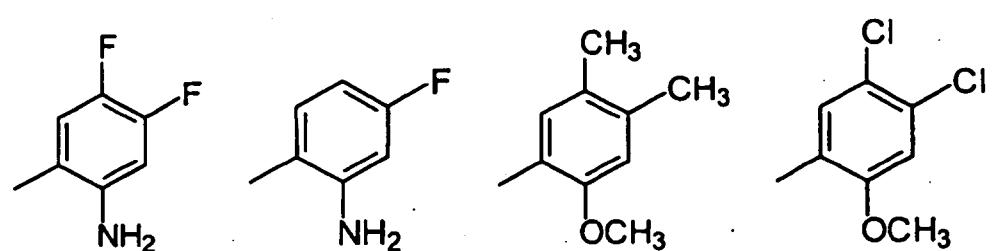
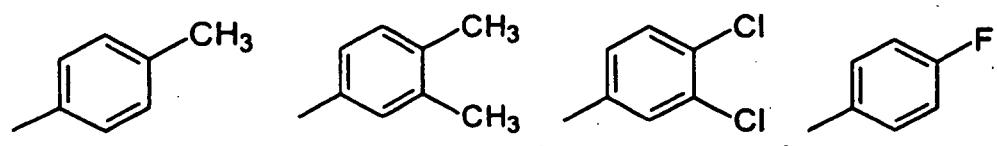
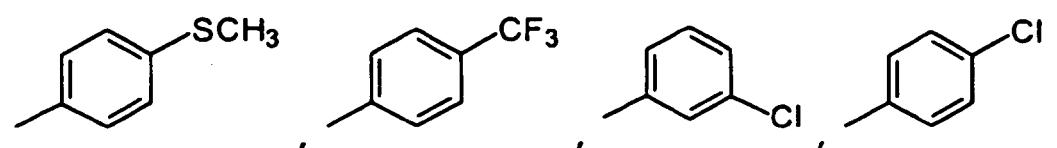
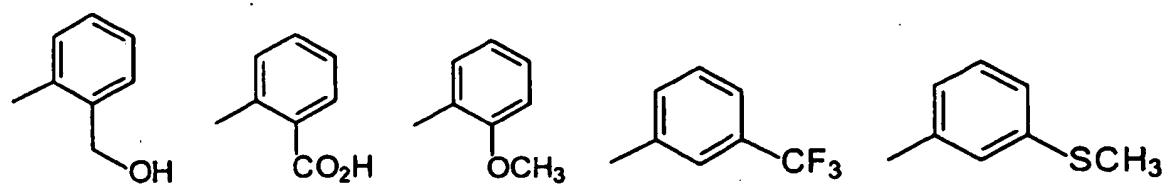
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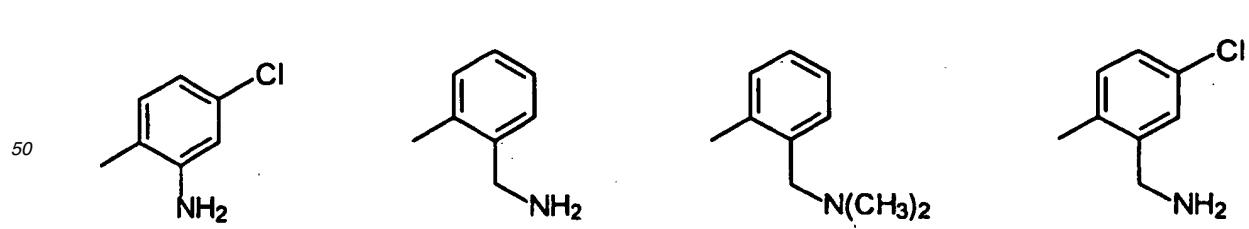
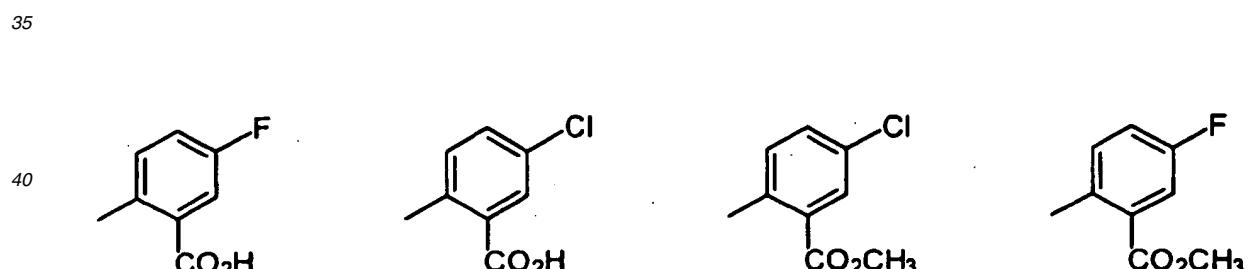
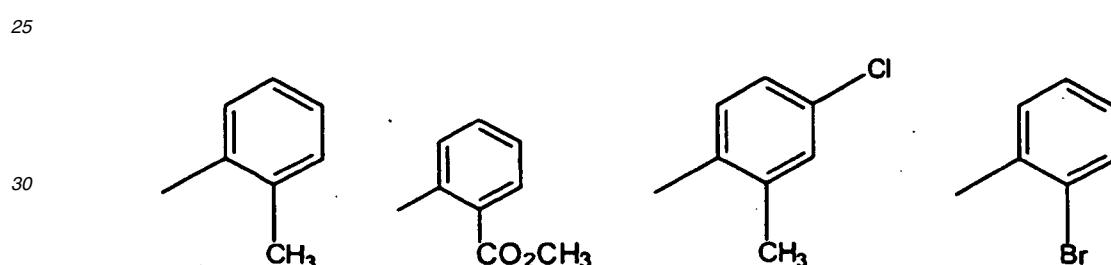
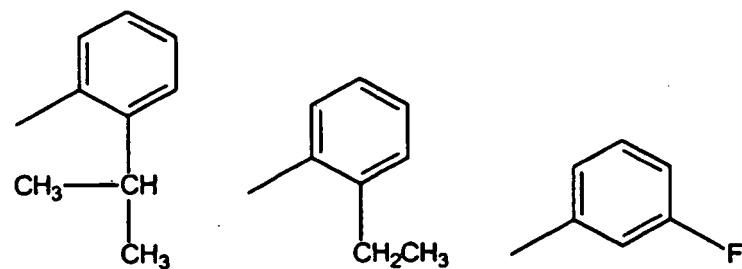
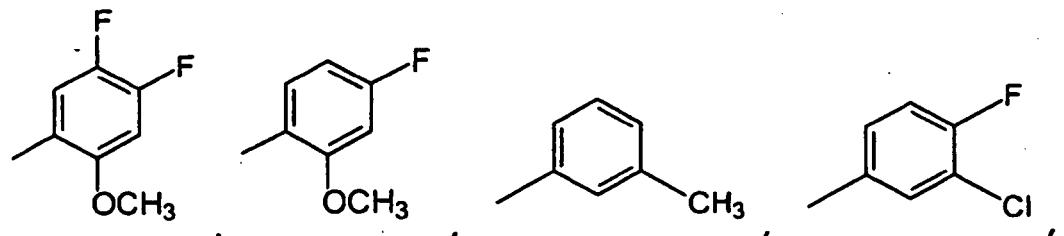


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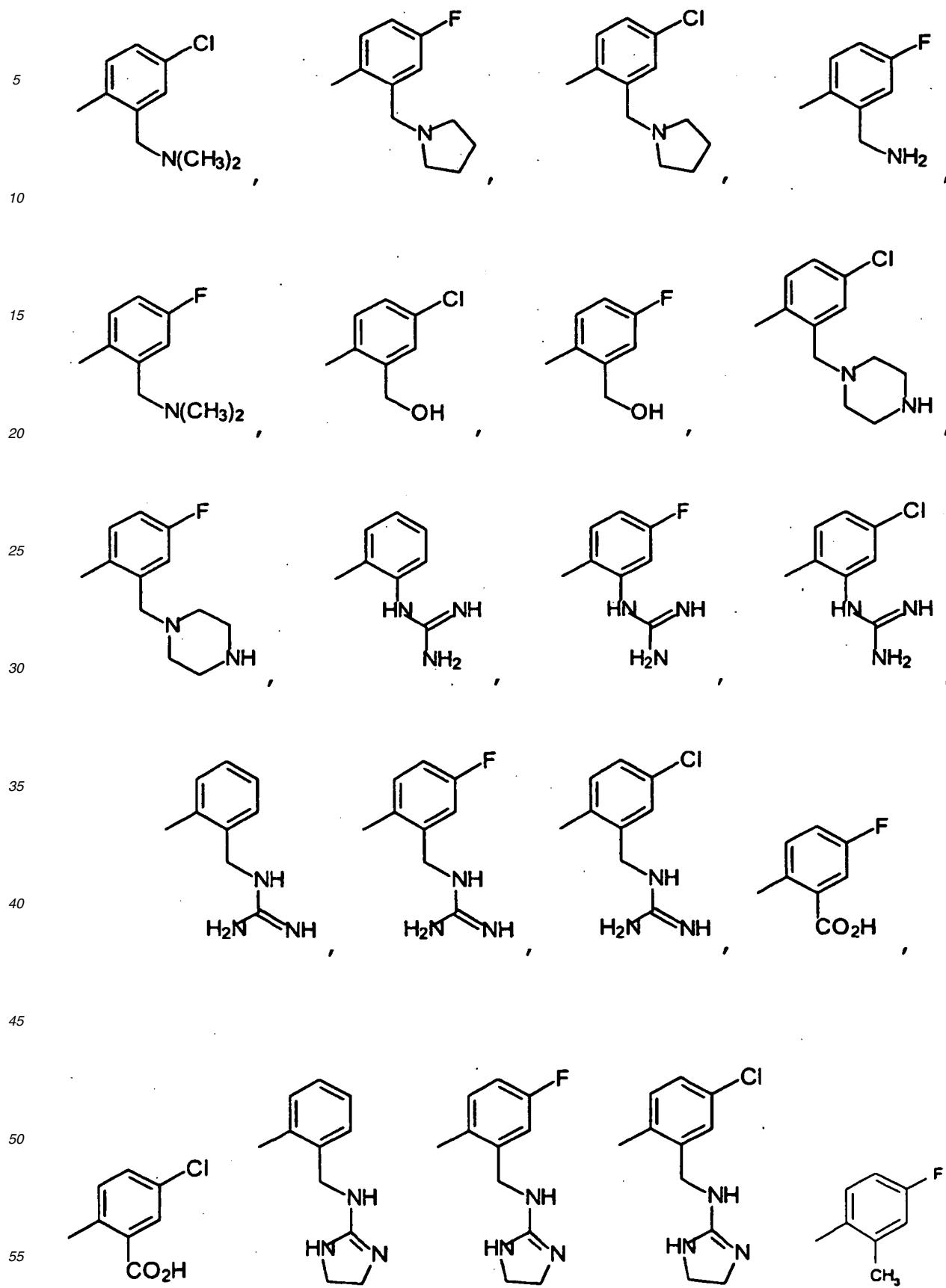
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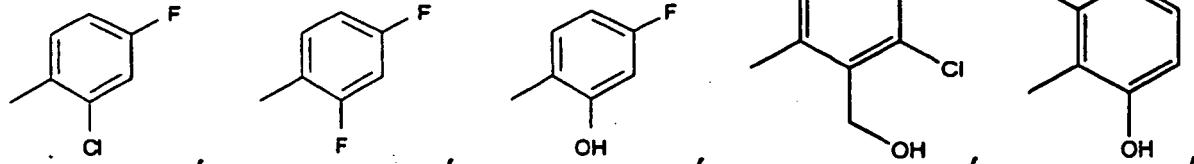
Q₂ is selected from:



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unsubstituted 2-pyridyl or unsubstituted phenyl;

R' is selected from hydrogen; (C₁-C₃)-alkyl; (C₂-C₃)-alkenyl or alkynyl; phenyl or phenyl substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl; or a 5-6 membered heterocyclic ring system optionally substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl;

15

R³ is selected from 5-8 membered aromatic or non-aromatic carbocyclic or heterocyclic ring systems;

W is selected from N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; N(R²)₂; C(O)-R²; CH(OH)-R²; C(O)-N(R²)₂; C(O)-OR²; or (C₁-C₄) straight or branched alkyl optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, R³, or SO₂N(R²)₂; or a 5-6 membered carbocyclic or heterocyclic ring system optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, or SO₂N(R²)₂; provided that W is not an R³ substituted C₁ alkyl;

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R² is selected from hydrogen, (C₁-C₃)-alkyl, or (C₁-C₃)-alkenyl; each optionally substituted with -N(R')₂, -OR', SR', -C(O)-N(R')₂, -S(O₂)-N(R')₂, -C(O)-OR';

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each Y is C, wherein each R and U attached to Y is independently selected from hydrogen or methyl;

Z is CH or N; and

V is -C(O)NH₂.

[0013] Most preferably, Q₁ is selected from 2-fluoro-6-trifluoromethylphenyl, 2,6-difluorophenyl, 2,6-dichlorophenyl, 2-chloro-4-hydroxyphenyl, 2-chloro-4-aminophenyl, 2,6-dichloro-4-aminophenyl, 2,6-dichloro-3-aminophenyl, 2,6-dimethyl-4-hydroxyphenyl, 2-methoxy-3,5-dichloro-4-pyridyl, 2-chloro-4,5 methylenedioxy phenyl, or 2-chloro-4-(N-2-morpholino-acetamido)phenyl.

[0014] Most preferred are compounds wherein Q₂ is selected from phenyl, 2-isopropylphenyl, 3,4-dimethylphenyl, 2-ethylphenyl, 3-fluorophenyl, 2-methylphenyl, 3-chloro-4-fluorophenyl, 3-chlorophenyl, 2-carbomethoxyphenyl, 2-carboxyphenyl, 2-methyl-4-chlorophenyl, 2-bromophenyl, 2-pyridyl, 2-methylenehydroxyphenyl, 4-fluorophenyl, 2-methyl-4-fluorophenyl, 2-chloro-4-fluorophenyl, 2,4-difluorophenyl, 2-hydroxy-4-fluorophenyl, 2-methylenehydroxy-4-fluorophenyl, or 3-chloro-2-methylenehydroxy.

[0015] According to an even more preferred embodiment, each Y is C, and W and/or U is not hydrogen.

[0016] Some preferred embodiments are provided in Table 1 to 6 below:

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Table 1.

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Cmpd Number	Structure
VRT-042196	

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Table 4.

Cmpd Number	Structure
VRT-042307	

Table 5.

Cmpd Number	Structure	Cmpd Number	Structure
VRT-041291		VRT-37742	
VRT-032884			
VRT-034465			

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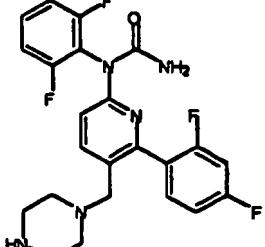
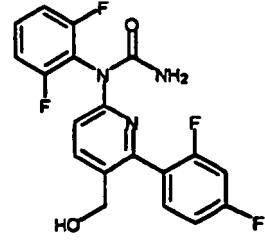
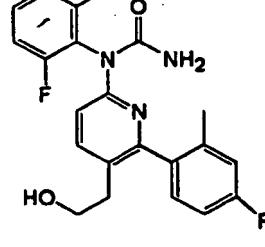
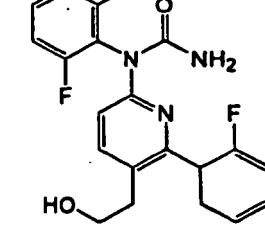
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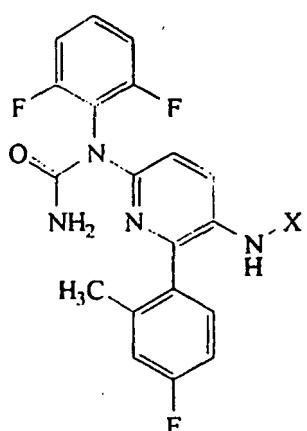
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Table 6.

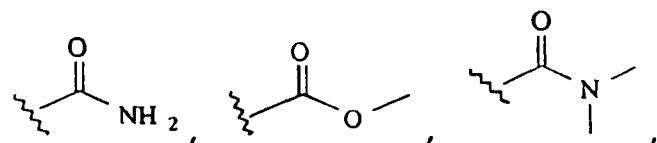
Cmpd Number	Structure
5	VRT-101094 
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15	VRT-043631 
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25	VRT-042266 
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35	VRT-042169 
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[0017] Particularly preferred embodiments include:

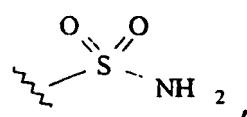


wherein X is H,

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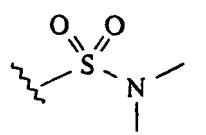
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or

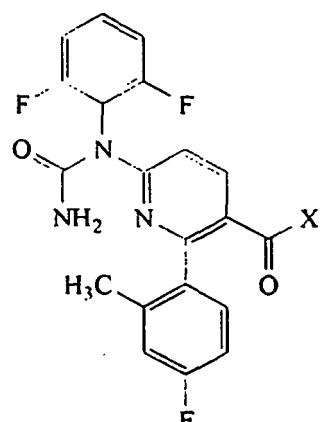
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[0018] Particularly preferred embodiments also include:

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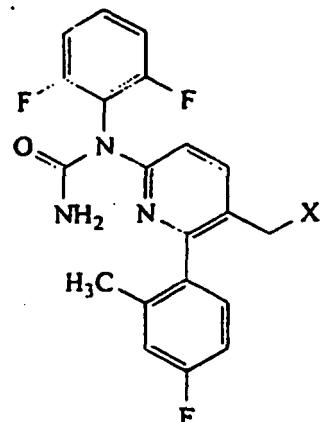
wherein X is NH₂ or N(CH₃)₂;

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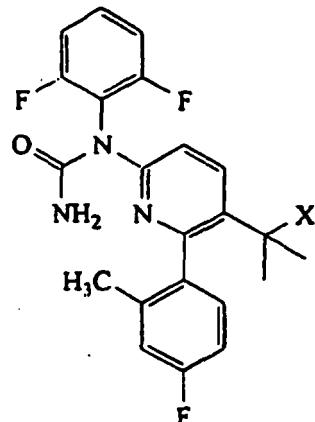
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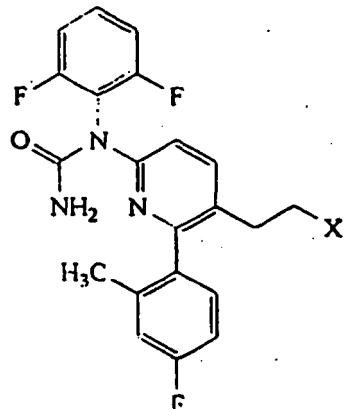
or

wherein X is OH, NH₂, or N(CH₃)₂.

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[0019] Other particularly preferred embodiments include:

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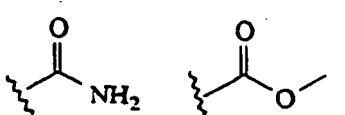
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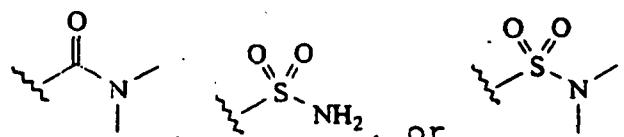
wherein X is OH, NH₂, N(CH₃)₂,

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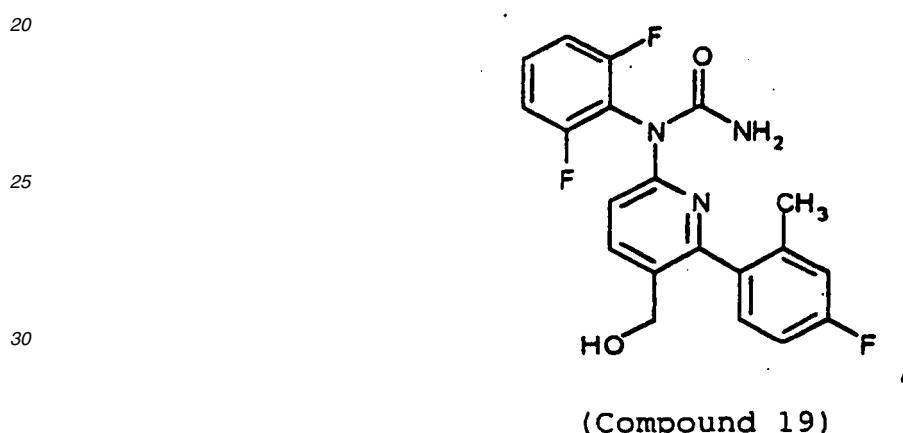
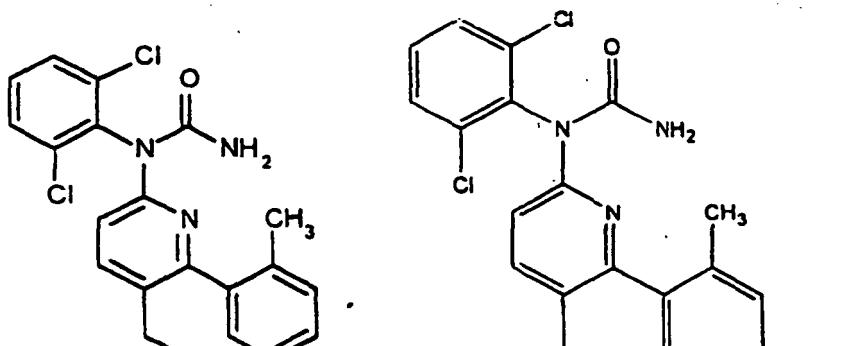
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55 [0020] Most preferred embodiments include:



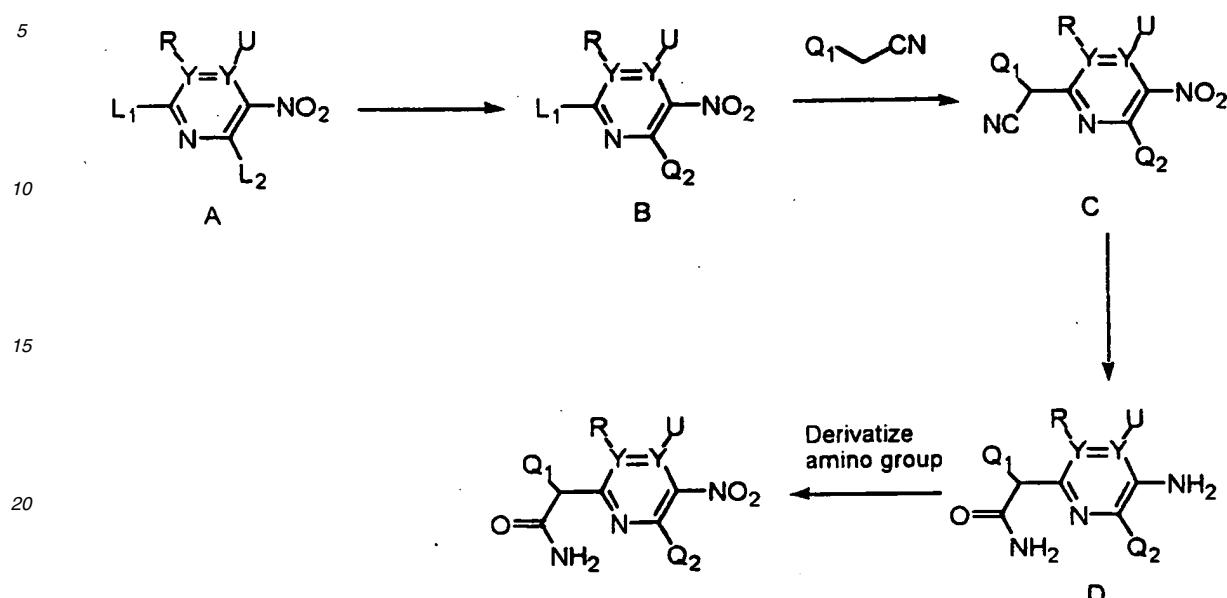
35 [0021] According to another embodiment, the present invention provides methods of producing the above-identified inhibitors of p38 of the formulae (Ia). Representative synthesis schemes for formula (Ia) are depicted below.

[0022] Schemes 1-3 illustrate the preparation of compounds in which W is either an amino, carboxyl or an aldehyde function. In each case the particular moiety may be modified through chemistry well known in the literature. For example the final amino compounds D and N (schemes 1 and 4 respectively) may be acylated, sulfonated or alkylated to prepare 40 compounds within the scope of W. In all schemes, the L1 and L2 groups on the initial materials are meant to represent leaving groups ortho to the nitrogen atom in a heterocyclic ring. For example, compound A may be 2,6-dichloro-3 nitro pyridine.

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Scheme 1

[0023] In Scheme 1, W is selected from amino-derivatized compounds such as $N(R^2)SO_2-N(R^2)_2$; $N(R^2)SO_2-N(R^2)(R^3)$; $N(R^2)C(O)-OR^2$; $N(R^2)C(O)-N(R^2)_2$; $N(R^2)C(O)-N(R^2)(R^3)$; $N(R^2)C(O)-R^2$; or $N(R^2)_2$.

[0024] In Scheme 1, the Q2 ring is introduced utilizing one of many reactions known in the art which result in the production of biaryl compounds. One example may be the reaction of an aryl lithium compound with the pyridine intermediate A. Alternatively, an arylmetallic compound such as an aryl stannane or an aryl boronic acid may be reacted with the aryl halide portion (intermediate A) in the presence of a Pd^0 catalyst to form product B. In the next step, a Q1 substituted derivative such as a phenyl acetonitrile derivative may be treated with a base such as sodium hydride, sodium amide, LDA, lithium hexamethyldisilazide or any number of other non-nucleophilic bases to deprotonate the position alpha to the cyano group, which represents a masked amide moiety. This anion is then contacted with intermediate B to form C. The nitrile or equivalent group of intermediate C is then hydrolyzed to form the amide and the nitro group is subjected to reducing conditions to form the amine intermediate D. Intermediate D is then used to introduce various functionality defined by W through chemistry such as acylation, sulfonylation or alkylation reactions well known in the literature. Depending on the regiochemistry of the first two steps of this procedure, the first two steps may need to be reversed.

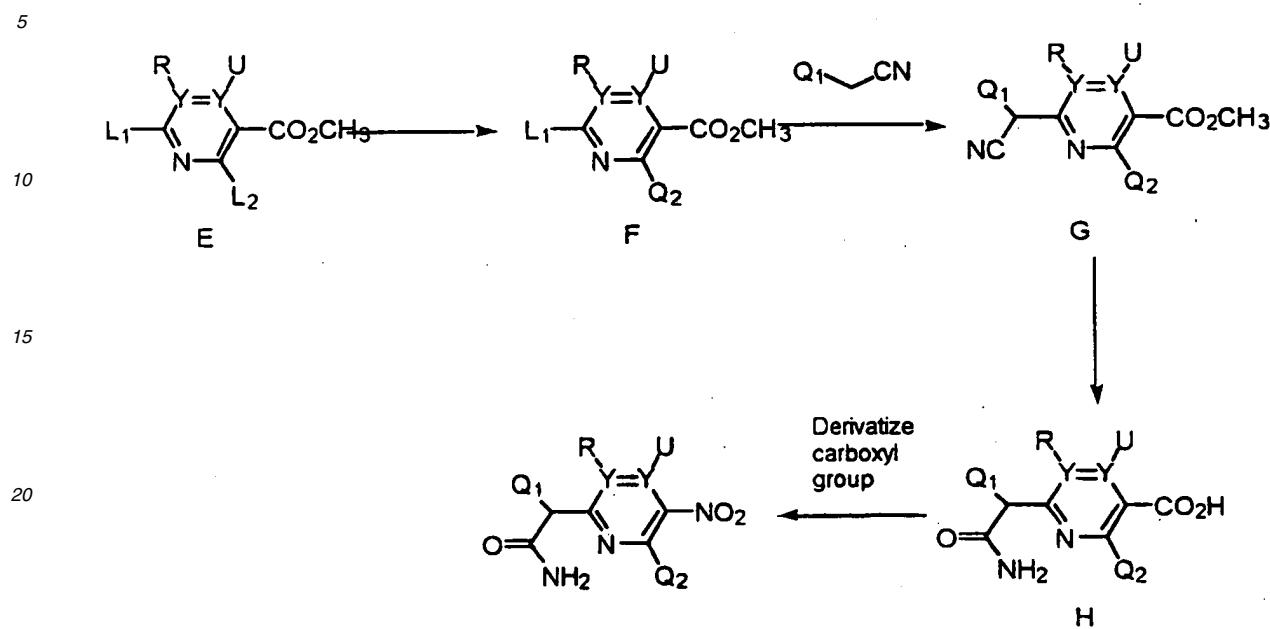
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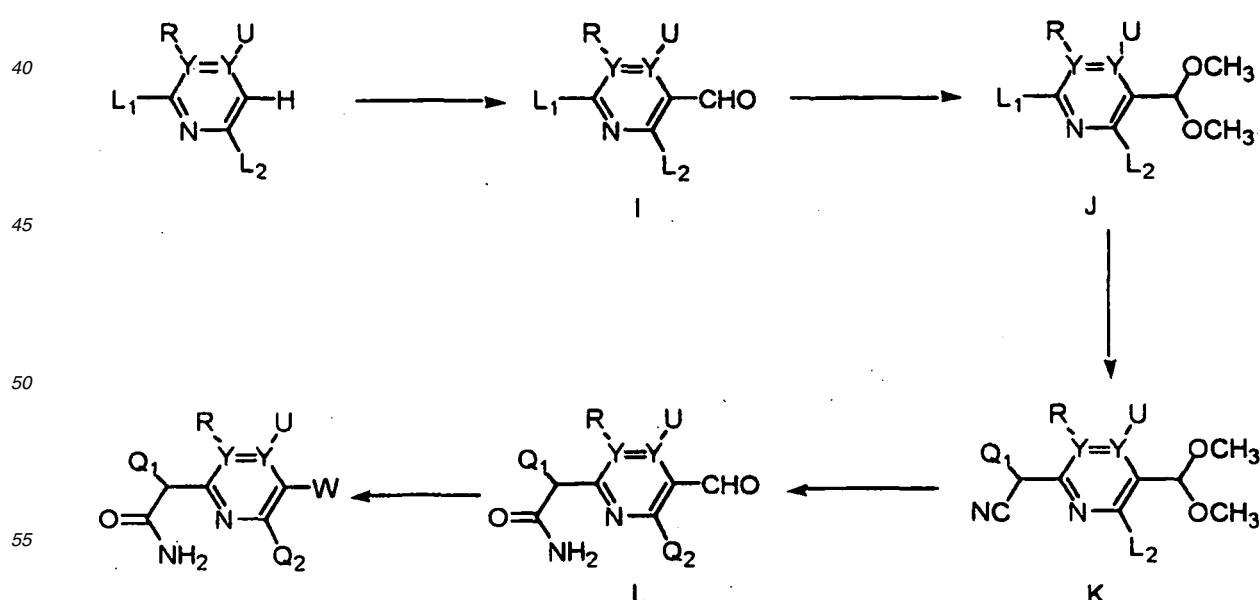
Scheme 2



[0025] In Scheme 2, W is selected from carboxyl-derivatized compounds such as C(O)-R²; CH(OH)-R²; C(O)-N(R²); or C(O)-OR².

[0026] Scheme 2 generally follows the procedures described for Scheme 1 except that a carboxyl intermediate such as E is the starting material. The first two steps mirror Scheme 1, and, as mentioned for Scheme 1, may be reversed depending on the regiochemistry of specific examples. Intermediate G is formed from these first two steps and this material may be hydrolyzed as mentioned for the carboxyl intermediate H. The carboxyl group may then be modified according to well-known procedures from the literature to prepare analogs with defined W substituents such as acylations, amidations and esterifications.

Scheme 3



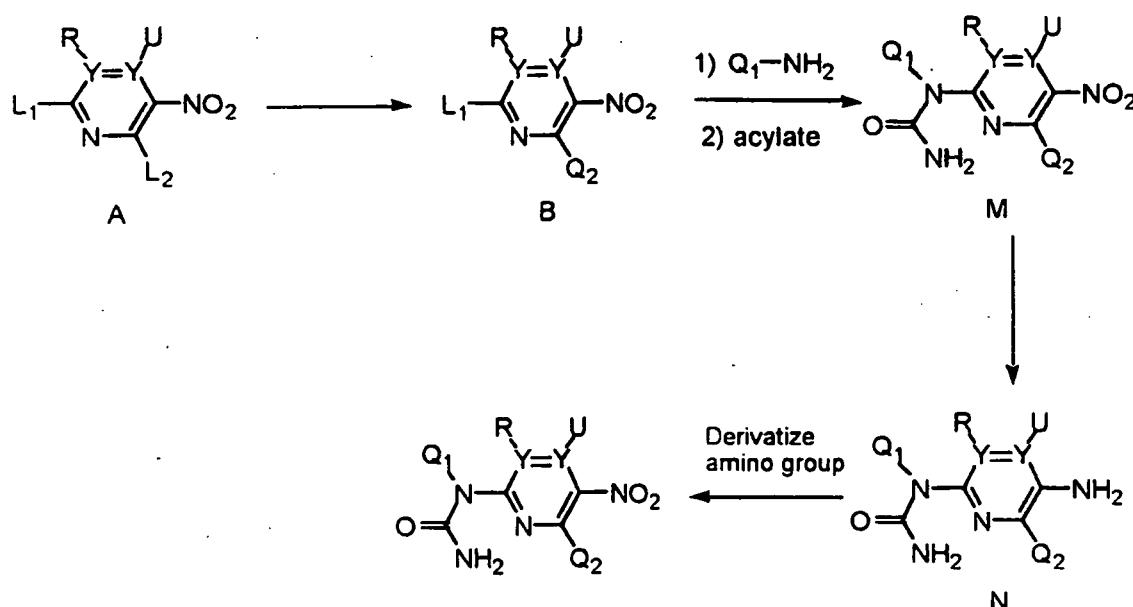
[0027] In Scheme 3, W is selected from (C₁-C₄) straight or branched alkyl optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, R³, or SO₂N(R²)₂; or a 5-6 membered carbocyclic or heterocyclic ring system optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, or SO₂N(R²)₂; provided that W is not an R³ substituted C₁ alkyl.

[0028] In scheme 3 a pyridine derivative is metalated and quenched with one of many known electrophiles which can generate an aldehyde, to form intermediate I. The aldehyde can then be masked to form the dimethyl acetal J. This intermediate is then carried on as described in scheme 1 and 2 to introduce the Q1 and Q2 substituents, to produce intermediate L. As before, these two steps may be interchanged depending on specific regiochemistry. The masked aldehyde of L may then be deprotected and utilized to form compounds with the defined W substitution using well known chemistry such as alkylations and reductive aminations.

[0029] Schemes 4-6 are similar to schemes 1-3 with the exception that the targeted compounds are those in which Z = Nitrogen. The steps for these schemes parallel 1-3 with the exception that the alkylation utilizing a phenyl acetonitrile is replaced with a reaction with a Q1 amine derivative such as a substituted aniline derivative. The amide portion of the molecule is then introduced in an acylation reaction with, for example, chlorosulfonyl isocyanate.

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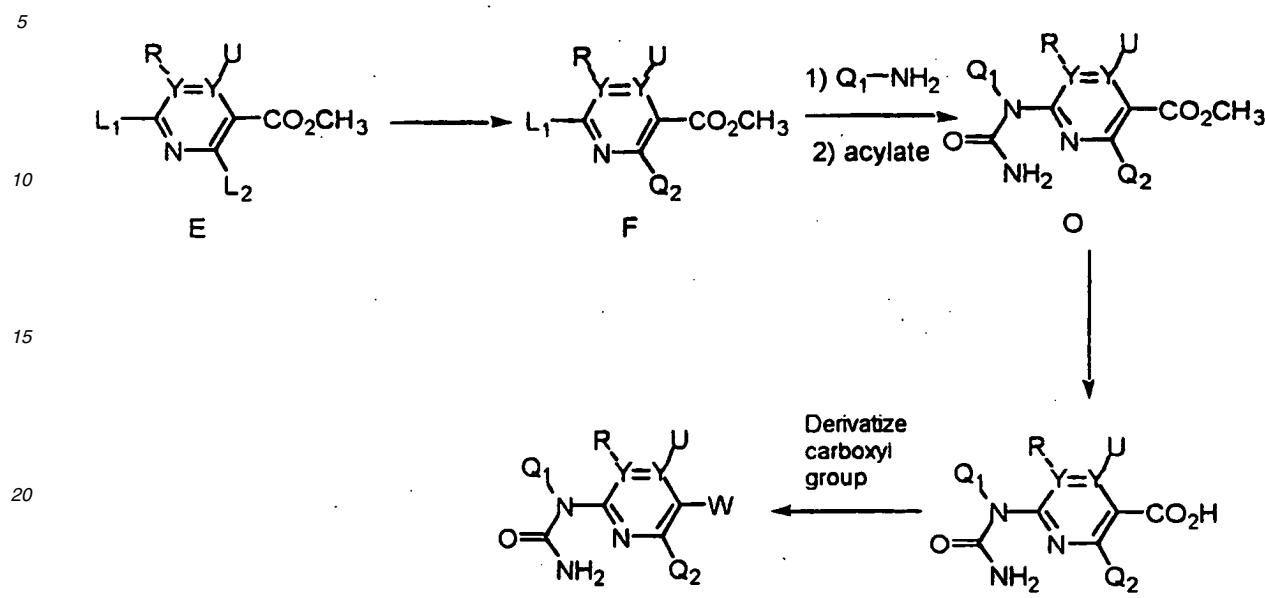
Scheme 4



[0030] In Scheme 4, W is selected from amino-derivatized groups such as N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; or N(R²)₂.

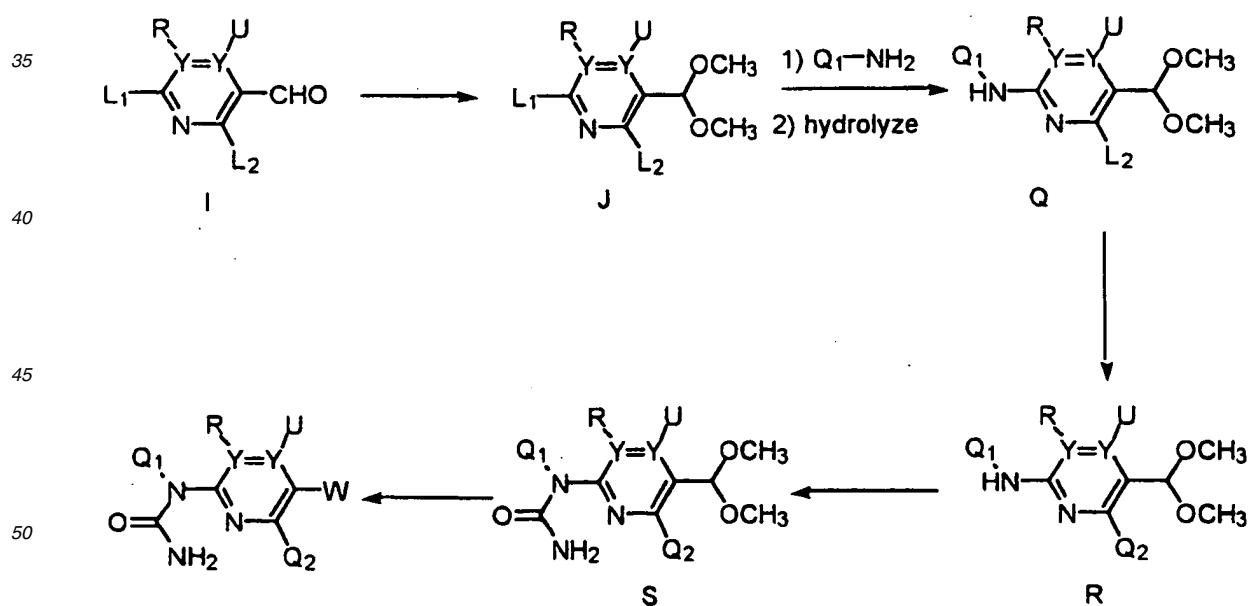
[0031] In Scheme 4, intermediate B (from scheme 1) is treated with, for example, an aniline derivative in the presence of a base such as potassium carbonate. Additionally, a palladium catalyst may be utilized to enhance the reactivity of this general type of reaction, if needed. The resulting amine derivative is then acylated to form intermediate M. The nitro group of M is then reduced to form N and the amino group may then be derivatized as described for scheme 1. As mentioned for schemes 1-3, the steps involved in the introduction of the Q1 and Q2 substituents may be interchanged depending on the specific regiochemistry of specific compounds.

Scheme 5



[0032] In Scheme 5, W is selected from carboxyl-derivatized groups such as C (O)-R²; CH(OH)-R²; C(O)-N(R²)₂; or C(O)-OR².

Scheme 6



[0033] In Scheme 6, W is selected from (C₁-C₄) straight or branched alkyl optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, R³, or SO₂N(R²)₂; or a 5-6 membered carbocyclic or heterocyclic ring system optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, or SO₂N(R²)₂; provided that W is not an R³ substituted C₁ alkyl.

[0034] Schemes 5 and 6 generally follow the procedures mentioned above.

[0035] According to another embodiment of the invention, the activity of the p38 inhibitors of this invention may be assayed *in vitro*, *in vivo* or in a cell line. *In vitro* assays include assays that determine inhibition of either the kinase activity or ATPase activity of activated p38. Alternate *in vitro* assays quantitate the ability of the inhibitor to bind to p39 and may be measured either by radiolabelling the inhibitor prior to binding, isolating the inhibitor/p38 complex and determining the amount of radiolabel bound, or by running a competition experiment where new inhibitors are incubated with p38 bound to known radioligands.

[0036] Cell culture assays of the inhibitory effect of the compounds of this invention may determine the amounts of TNF, IL-1, IL-6 or IL-8 produced in whole blood or cell fractions thereof in cells treated with inhibitor as compared to cells treated with negative controls. Level of these cytokines may be determined through the use of commercially available ELISAs.

[0037] An *in vivo* assay useful for determining the inhibitory activity of the p38 inhibitors of this invention are the suppression of hind paw edema in rats with *Mycobacterium butyricum*-induced adjuvant arthritis. This is described in J.C. Boehm et al., J. Med. Chem., 39, pp. 3929-37 (1996), the disclosure of which is herein incorporated by reference. The p38 inhibitors of this invention may also be assayed in animal models of arthritis, bone resorption, endotoxin shock and immune function, as described in A. M. Badger et al., J. Pharmacol. Experimental Therapeutics, 279, pp. 1453-61 (1996), the disclosure of which is herein incorporated by reference.

[0038] The p38 inhibitors or pharmaceutical salts thereof may be formulated into pharmaceutical compositions for administration to animals or humans. These pharmaceutical compositions, which comprise an amount of p38 inhibitor effective to treat or prevent a p38-mediated condition and a pharmaceutically acceptable carrier, are another embodiment of the present invention.

[0039] The term "p38-mediated condition", as used herein means any disease or other deleterious condition in which p38 is known to play a role. This includes conditions known to be caused by IL-1, TNF, IL-6 or IL-8 overproduction. Such conditions include, without limitation, inflammatory diseases, autoimmune diseases, destructive bone disorders, proliferative disorders, infectious diseases, neurodegenerative diseases, allergies, reperfusion/ischemia in stroke, heart attacks, angiogenic disorders, organ hypoxia, vascular hyperplasia, cardiac hypertrophy, thrombin-induced platelet aggregation, and conditions associated with prostaglandin endoperoxidase synthase-2.

[0040] Inflammatory diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, acute pancreatitis, chronic pancreatitis, asthma, allergies, and adult respiratory distress syndrome.

[0041] Autoimmune diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, glomerulonephritis, rheumatoid arthritis, systemic lupus erythematosus, scleroderma, chronic thyroiditis, Graves' disease, autoimmune gastritis, diabetes, autoimmune hemolytic anemia, autoimmune neutropenia, thrombocytopenia, atopic dermatitis, chronic active hepatitis, myasthenia gravis, multiple sclerosis, inflammatory bowel disease, ulcerative colitis, Crohn's disease, psoriasis, or graft vs. host disease.

[0042] Destructive bone disorders which may be treated or prevented by the compounds of this invention include, but are not limited to, osteoporosis, osteoarthritis and multiple myeloma-related bone disorder.

[0043] Proliferative diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, acute myelogenous leukemia, chronic myelogenous leukemia, metastatic melanoma, Kaposi's sarcoma, and multiple myeloma.

[0044] Angiogenic disorders which may be treated or prevented by the compounds of this invention include solid tumors, ocular neovascularization, infantile haemangiomas.

[0045] Infectious diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, sepsis, septic shock, and Shigellosis.

[0046] Viral diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, acute hepatitis infection (including hepatitis A, hepatitis B and hepatitis C), HIV infection and CMV retinitis.

[0047] Neurodegenerative diseases which may be treated or prevented by the compounds of this invention include, but are not limited to, Alzheimer's disease, Parkinson's disease, cerebral ischemias or neurodegenerative disease caused by traumatic injury.

[0048] "p38-mediated conditions" also include ischemia/reperfusion in stroke, heart attacks, myocardial ischemia, organ hypoxia, vascular hyperplasia, cardiac hypertrophy, and thrombin-induced platelet aggregation.

[0049] In addition, p38 inhibitors of the instant invention are also capable of inhibiting the expression of inducible pro-inflammatory proteins such as prostaglandin endoperoxide synthase-2 (PGHS-2), also referred to as cyclooxygenase-2 (COX-2). Therefore, other "p38-mediated conditions" which may be treated by the compounds of this invention include edema, analgesia, fever and pain, such as neuromuscular pain, headache, cancer pain, dental pain and arthritis pain.

[0050] The diseases that may be treated or prevented by the p38 inhibitors of this invention may also be conveniently grouped by the cytokine (IL-1, TNF, IL-6, IL-8) that is believed to be responsible for the disease.

[0051] Thus, an IL-1-mediated disease or condition includes rheumatoid arthritis, osteoarthritis, stroke, endotoxemia and/or toxic shock syndrome, inflammatory reaction induced by endotoxin, inflammatory bowel disease, tuberculosis, atherosclerosis, muscle degeneration, cachexia, psoriatic arthritis, Reiter's syndrome, gout, traumatic arthritis, rubella

arthritis, acute synovitis, diabetes, pancreatic β -cell disease and Alzheimer's disease.

[0052] TNF-mediated disease or condition includes, rheumatoid arthritis, rheumatoid spondylitis, osteoarthritis, gouty arthritis and other arthritic conditions, sepsis, septic shock, endotoxic shock, gram negative sepsis, toxic shock syndrome, adult respiratory distress syndrome, cerebral malaria, chronic pulmonary inflammatory disease, silicosis, pulmonary sarcosclerosis, bone resorption diseases, reperfusion injury, graft vs. host reaction, allograft rejections, fever and myalgias due to infection, cachexia secondary to infection, AIDS, ARC or malignancy, keloid formation, scar tissue formation, Crohn's disease, ulcerative colitis or pyresis. TNF-mediated diseases also include viral infections, such as HIV, CMV, influenza and herpes; and veterinary viral infections, such as lentivirus infections, including, but not limited to equine infectious anemia virus, caprine arthritis virus, visna virus or maedi virus; or retrovirus infections, including feline immunodeficiency virus, bovine immunodeficiency virus, or canine immunodeficiency virus.

[0053] IL-8 mediated disease or condition includes diseases characterized by massive neutrophil infiltration, such as psoriasis, inflammatory bowel disease, asthma, cardiac and renal reperfusion injury, adult respiratory distress syndrome, thrombosis and glomerulonephritis.

[0054] In addition, the compounds of this invention may be used topically to treat or prevent conditions caused or exacerbated by IL-1 or TNF. Such conditions include inflamed joints, eczema, psoriasis, inflammatory skin conditions such as sunburn, inflammatory eye conditions such as conjunctivitis, pyresis, pain and other conditions associated with inflammation.

[0055] In addition to the compounds of this invention, pharmaceutically acceptable salts of the compounds of this invention may also be employed in compositions to treat or prevent the above-identified disorders.

[0056] Pharmaceutically acceptable salts of the compounds of this invention include those derived from pharmaceutically acceptable inorganic and organic acids and bases. Examples of suitable acid salts include acetate, adipate, alginic acid, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, citrate, camphorate, camphorsulfonate, cyclopentanepropionate, digluconate, dodecylsulfate, ethanesulfonate, formate, fumarate, glucoheptanoate, glycerophosphate, glycolate, hemisulfate, heptanoate, hexanoate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxyethanesulfonate, lactate, maleate, malonate, methanesulfonate, 2-naphthalenesulfonate, nicotinate, nitrate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, phosphate, picrate, pivalate, propionate, salicylate, succinate, sulfate, tartrate, thiocyanate, tosylate and undecanoate. Other acids, such as oxalic, while not in themselves pharmaceutically acceptable, may be employed in the preparation of salts useful as intermediates in obtaining the compounds of the invention and their pharmaceutically acceptable acid addition salts. Salts derived from appropriate bases include alkali metal (e.g., sodium and potassium), alkaline earth metal (e.g., magnesium), ammonium and N-(C1-4 alkyl)4+ salts. This invention also envisions the quaternization of any basic nitrogen-containing groups of the compounds disclosed herein. Water or oil-soluble or dispersible products may be obtained by such quaternization.

[0057] Pharmaceutically acceptable carriers that may be used in these pharmaceutical compositions include, but are not limited to, ion exchangers, alumina, aluminum stearate, lecithin, serum proteins, such as human serum albumin, buffer substances such as phosphates, glycine, sorbic acid, potassium sorbate, partial glyceride mixtures of saturated vegetable fatty acids, water, salts or electrolytes, such as protamine sulfate, disodium hydrogen phosphate, potassium hydrogen phosphate, sodium chloride, zinc salts, colloidal silica, magnesium trisilicate, polyvinyl pyrrolidone, cellulose-based substances, polyethylene glycol, sodium carboxymethylcellulose, polyacrylates, waxes, polyethylene-polyoxypropylene-block polymers, polyethylene glycol and wool fat.

[0058] The compositions of the present invention may be administered orally, parenterally, by inhalation spray, topically, rectally, nasally, buccally, vaginally or via an implanted reservoir. The term "parenteral" as used herein includes subcutaneous, intravenous, intramuscular, intra-articular, intra-synovial, intrasternal, intrathecal, intrahepatic, intralesional and intracranial injection or infusion techniques. Preferably, the compositions are administered orally, intraperitoneally or intravenously.

[0059] Sterile injectable forms of the compositions of this invention may be aqueous or oleaginous suspension. These suspensions may be formulated according to techniques known in the art using suitable dispersing or wetting agents and suspending agents. The sterile injectable preparation may also be a sterile injectable solution or suspension in a non-toxic parenterally-acceptable diluent or solvent, for example as a solution in 1,3-butanediol. Among the acceptable vehicles and solvents that may be employed are water, Ringer's solution and isotonic sodium chloride solution. In addition, sterile, fixed oils are conventionally employed as a solvent or suspending medium. For this purpose, any bland fixed oil may be employed including synthetic mono- or di-glycerides. Fatty acids, such as oleic acid and its glyceride derivatives are useful in the preparation of injectables, as are natural pharmaceutically-acceptable oils, such as olive oil or castor oil, especially in their polyoxyethylated versions. These oil solutions or suspensions may also contain a long-chain alcohol diluent or dispersant, such as carboxymethyl cellulose or similar dispersing agents which are commonly used in the formulation of pharmaceutically acceptable dosage forms including emulsions and suspensions. Other commonly used surfactants, such as Tweens, Spans and other emulsifying agents or bioavailability enhancers which are commonly used in the manufacture of pharmaceutically acceptable solid, liquid, or other dosage forms may also be used for the purposes of formulation.

[0060] The pharmaceutical compositions of this invention may be orally administered in any orally acceptable dosage form including, but not limited to, capsules, tablets, aqueous suspensions or solutions. In the case of tablets for oral use, carriers commonly used include lactose and corn starch. Lubricating agents, such as magnesium stearate, are also typically added. For oral administration in a capsule form, useful diluents include lactose and dried cornstarch. When aqueous suspensions are required for oral use, the active ingredient is combined with emulsifying and suspending agents. If desired, certain sweetening, flavoring or coloring agents may also be added.

[0061] Alternatively, the pharmaceutical compositions of this invention may be administered in the form of suppositories for rectal administration. These can be prepared by mixing the agent with a suitable nonirritating excipient which is solid at room temperature but liquid at rectal temperature and therefore will melt in the rectum to release the drug. Such materials include cocoa butter, beeswax and polyethylene glycols.

[0062] The pharmaceutical compositions of this invention may also be administered topically, especially when the target of treatment includes areas or organs readily accessible by topical application, including diseases of the eye, the skin, or the lower intestinal tract. Suitable topical formulations are readily prepared for each of these areas or organs.

[0063] Topical application for the lower intestinal tract can be effected in a rectal suppository formulation (see above) or in a suitable enema formulation. Topically-transdermal patches may also be used.

[0064] For topical applications, the pharmaceutical compositions may be formulated in a suitable ointment containing the active component suspended or dissolved in one or more carriers. Carriers for topical administration of the compounds of this invention include, but are not limited to, mineral oil, liquid petrolatum, white petrolatum, propylene glycol, polyoxyethylene, polyoxypropylene compound, emulsifying wax and water. Alternatively, the pharmaceutical compositions can be formulated in a suitable lotion or cream containing the active components suspended or dissolved in one or more pharmaceutically acceptable carriers. Suitable carriers include, but are not limited to, mineral oil, sorbitan monostearate, polysorbate 60, cetyl esters wax, cetearyl alcohol, 2-octyldodecanol, benzyl alcohol and water.

[0065] For ophthalmic use, the pharmaceutical compositions may be formulated as micronized suspensions in isotonic, pH adjusted sterile saline, or, preferably, as solutions in isotonic, pH adjusted sterile saline, either with or without a preservative such as benzylalkonium chloride. Alternatively, for ophthalmic uses, the pharmaceutical compositions may be formulated in an ointment such as petrolatum.

[0066] The pharmaceutical compositions of this invention may also be administered by nasal aerosol or inhalation. Such compositions are prepared according to techniques well-known in the art of pharmaceutical formulation and may be prepared as solutions in saline, employing benzyl alcohol or other suitable preservatives, absorption promoters to enhance bioavailability, fluorocarbons, and/or other conventional solubilizing or dispersing agents.

[0067] The amount of p38 inhibitor that may be combined with the carrier materials to produce a single dosage form will vary depending upon the host treated, the particular mode of administration. Preferably, the compositions should be formulated so that a dosage of between 0.01 - 100 mg/kg body weight/day of the inhibitor can be administered to a patient receiving these compositions.

[0068] It should also be understood that a specific dosage and treatment regimen for any particular patient will depend upon a variety of factors, including the activity of the specific compound employed, the age, body weight, general health, sex, diet, time of administration, rate of excretion, drug combination, and the judgment of the treating physician and the severity of the particular disease being treated. The amount of inhibitor will also depend upon the particular compound in the composition.

[0069] According to another embodiment, a p38-mediated condition is to be treated or prevented by administering to a patient one of the above-described pharmaceutical compositions. The term "patient", as used herein, means an animal, preferably a human.

[0070] Preferably, that condition to be treated or prevented is selected from inflammatory diseases, autoimmune diseases, destructive bone disorders, proliferative disorders, infectious diseases, degenerative diseases, allergies, reperfusion/ischemia in stroke, heart attacks, angiogenic disorders, organ hypoxia, vascular hyperplasia, cardiac hypertrophy, and thrombin-induced platelet aggregation.

[0071] According to another embodiment, the inhibitors of this invention are used to treat or prevent an IL-1, IL-6, IL-8 or TNF-mediated disease or condition. Such conditions are described above.

[0072] Depending upon the particular p38-mediated condition to be treated or prevented, additional drugs, which are normally administered to treat or prevent that condition, may be administered together with the inhibitors of this invention. For example, chemotherapeutic agents or other anti-proliferative agents may be combined with the p38 inhibitors of this invention to treat proliferative diseases.

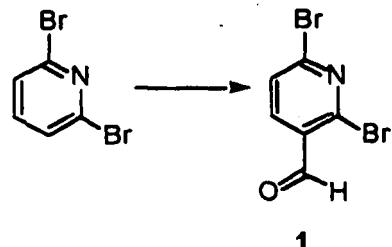
[0073] Those additional agents may be administered separately, as part of a multiple dosage regimen, from the p38 inhibitor-containing composition. Alternatively, those agents may be part of a single dosage form, mixed together with the p38 inhibitor in a single composition.

[0074] In order that the invention described herein may be more fully understood, the following examples are set forth. It should be understood that these examples are for illustrative purposes only and are not to be construed as limiting this invention in any manner.

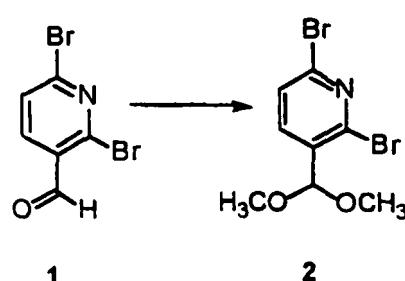
EXAMPLE 1

Synthesis of p38 Inhibitor Compound 6

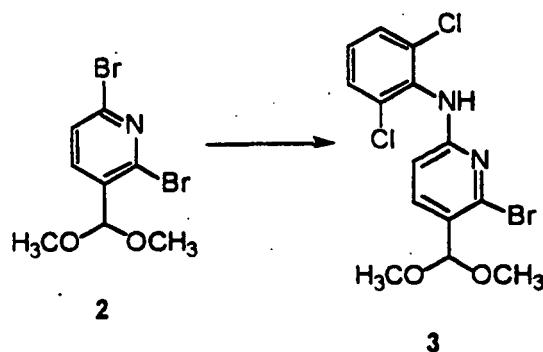
5 [0075]



[0076] To a solution of LDA (60mmol, 40mLs) at -78° C, was added dropwise a solution of 2,6-Dibromopyridine (40mmol, 9.48gms) in THF (30mLs, dried). The mixture was stirred at -78° C for 20 minutes. Ethyl formate (400mmol, 32.3mLs) was added and stirring was continued at -78° C for 2 hours. Saturated ammonium chloride (200mLs) was added and the mixture was warmed to room temperature. The reaction mixture was diluted with ethyl acetate and the organic layer was washed with aqueous acid and base. The organic layer was dried and evaporated *in vacuo*. The resulting material was purified by flash chromatography on silica gel followed by eluting with 10% ethyl acetate in n-hexane to afford 1 (32mmol, 8.41gms) as a white solid.



[0077] A solution of **1** (13.08mmol, 3.1gms) and concentrated sulfuric acid (1mL in methanol (50mL) was refluxed overnight. The reaction mixture was cooled, neutralized with aqueous base and extracted into ethyl acetate. Drying and evaporation of the organic layer afforded **2** (11.77mmol, 3.63gms) as an oil.



[0078] To a solution of t-Butoxide (2.2mmol, 2mLs) was added dropwise a solution of 2,6-Dichloroaniline (1.0mmol, 162mgs) in THF (2mL, dried). The mixture was stirred at room temperature for 20 minutes. A solution of 2 (1.0mmol, 309mgs) in THF (5mLs) was added and stirring was continued for 3 hours. The reaction mixture was diluted with ethyl

acetate and the organic layer was washed with aqueous acid and base. The organic layer was dried and evaporated *in vacuo*. The resulting material was purified by flash chromatography on silica gel followed by eluting with 5% acetone in n-hexane to afford 3 (0.33mmol, 128mgs) as an orange solid.

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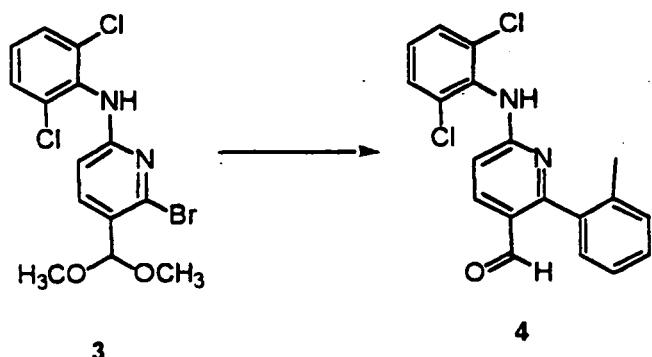
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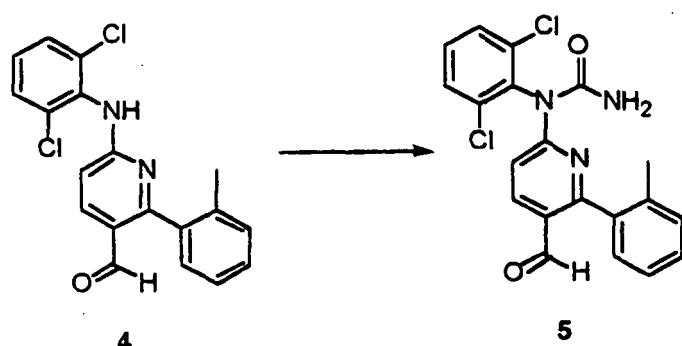
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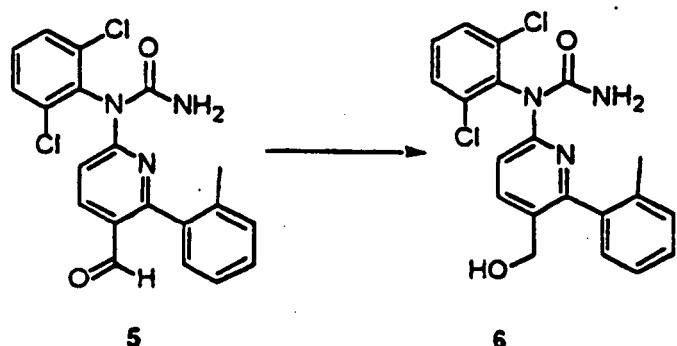
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[0079] o-Tolylboronic acid (0.34mmol, 46mgs), and **3** (0.20mmol, 80mgs) were dissolved in a toluene/ethanol (5/1) mixture. Thallium carbonate (0.5, 235mgs) and tetrakis(triphenylphosphine)palladium (0) (10mgs) was added to the solution and the slurry was allowed to reflux for 30 minutes. The reaction mixture was diluted with ethyl acetate and the organic layer was washed with aqueous acid and base. The organic layer was dried and evaporated *in vacuo*. The resulting material was purified by flash chromatography on silica gel followed by eluting with 5% methanol in methylene chloride to afford **4** (0.17mmol, 61mgs) as a white solid.



[0080] A solution of **4** (0.17mmol, 61mgs) and chlorosulfonyl isocyanate (1mmol, 141.5mgs) in methylene chloride (5mLs) was stirred at room temperature overnight. The reaction mixture was diluted with ethyl acetate and the organic layer was washed with aqueous acid and base. The organic layer was dried and evaporated *in vacuo*. The resulting material was purified by flash chromatography on silica gel followed by eluting with 5% acetone in n-hexane to afford **5** (0.12mmol, 46mgs) as a white solid.



15 [0081] Sodium borohydride (1.0mmol, 39.8 mgs) was added to a solution of **5** (0.12mmol, 46mgs) in methanol (10mLs) and the solution was stirred for 15 minutes. The reaction was quenched with water. The reaction mixture was then diluted with ethyl acetate and the organic layer was washed with aqueous acid and base. The organic layer was dried and evaporated in vacuo. The resulting material was purified by flash chromatography to afford **6** (0.08mmol, 36mgs) as a white solid.

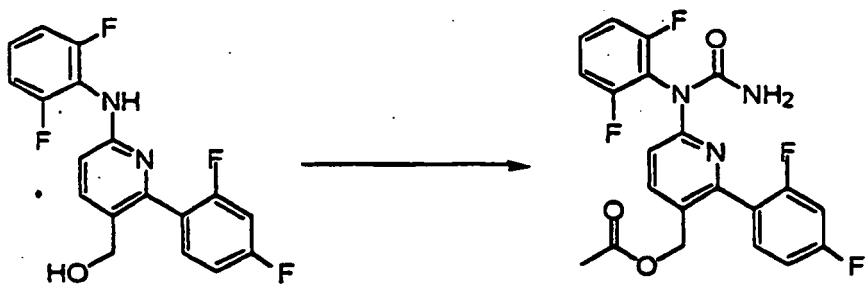
20 [0082] The spectral data for compound **6** was:

¹H NMR (500 MHz, CDCl₃) δ 7.90 (d, 1H), 7.60 (d, 2H), 7.5-7.3 (m, 5H), 6.30 (d, 2H), 4.5 (s, 2H), 2.3 (s, 2H).

Synthesis of Reference p38 Inhibitor Compound 7

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〔0083〕



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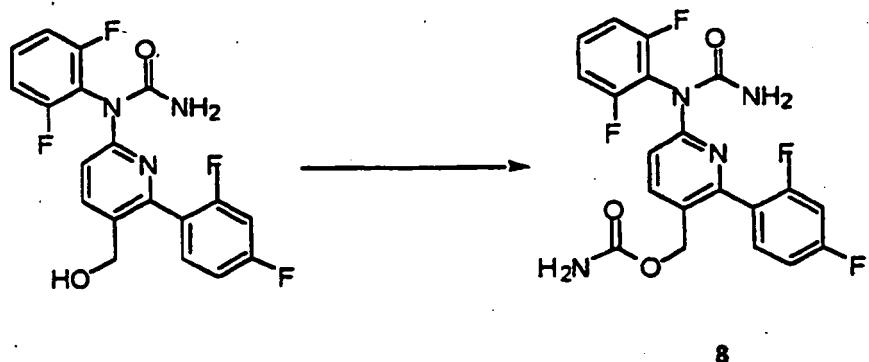
[0084] The amino-alcohol (500 mg, 1.43 mmol), which was prepared in the same manner as 4, was dissolved in dichloromethane. Triethylamine (433 mg, 4.29 mmol) was added, followed by acetyl chloride (168 mg, 2.15 mmol). The mixture was stirred at room temperature for one hour, poured into water, and extracted with dichloromethane. The organic extract was evaporated *in vacuo* and the residue was dissolved in 10.0 mL of toluene. A 20% solution of phosgene in toluene (5.0 mL) was added and the solution was refluxed for two hours. The solution was cooled and 5.0 mL of concentrated ammonium hydroxide was added, precipitating a white solid. The mixture was poured into water and extracted with toluene. The organic extract was dried (MgSO_4) and evaporated *in vacuo* to afford 205 mg of the urea-acetate 7 as a white solid.

50 [0085] The spectral data for Reference compound 7 was:

¹H NMR (500 MHz, CDCl₃) δ 7.80 (d, 1H), 7.62-7.50 (m, 2H), 7.25-7.0 (m, 5H), 6.59 (d, 1H), 5.1 (s, 2H), 2.12 (s, 3H). HRMS showed MH⁺ 434.2 as the major peak.

55 Synthesis of Reference p38 Inhibitor Compound 8

[0086]



[0087] The urea-alcohol (548 mg, 1.4 mmol), which was prepared in the same manner as **6**, was dissolved in 5.0 mL of toluene. A 20% solution of phosgene in toluene (5.0 mL) was added and the solution was refluxed for two hours. The solution was cooled and 5.0 mL of concentrated ammonium hydroxide was added, precipitating a white solid. The mixture was poured into water and extracted with toluene. The organic extract was dried (MgSO_4) and evaporated *in vacuo* to afford 284 mg of the carbamate **8** as a white solid.

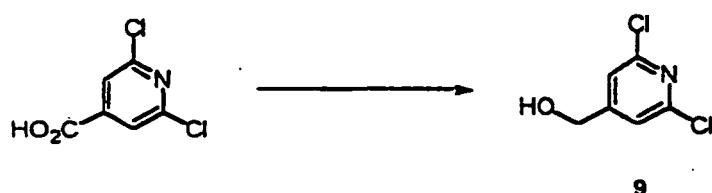
[0088] The spectral data of Reference compound **8** was:

¹H NMR (500 MHz, CDCl₃) δ 7.77 (d, 1H), 7.55-7.45 (m, 2H), 7.15-6.95 (m, 5H), 6.50 (d, 1H), 5.40 (br s, 2H), 5.00 (s, 2H). HRMS showed MH⁺ 435.1 as the major peak.

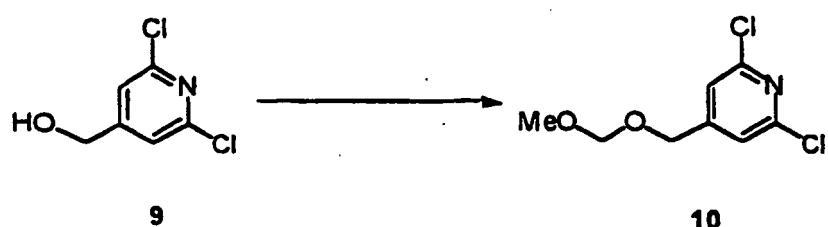
EXAMPLE 2

Synthesis of Reference p38 Inhibitor Compound 16

[0089]

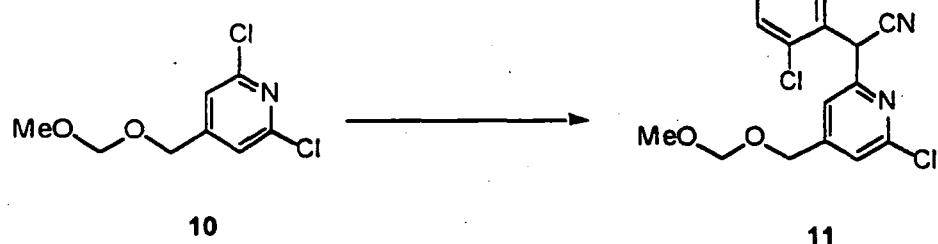


[0090] One equivalent of 2,6-dichloropyridine-4-carboxylic acid was dissolved in THF. The solution was cooled to 0°C and one equivalent of borane dimethyl sulfide complex was added. The solution was stirred at room temperature for twelve hours. The mixture was poured into water and extracted with diethyl ether. The ether extract was dried, and evaporated in vacuo to afford **9** in 93% yield.



55 [0091] One equivalent of **9** was dissolved in methylene chloride. One equivalent of methyl chloromethyl ether was added, followed by the addition of one equivalent of ethyl diisopropylamine. The reaction was stirred at room temperature for several hours, poured into water and extracted with a water-immiscible solvent. The extract was dried and evaporated in *vacuo* to afford **10** in 86% yield.

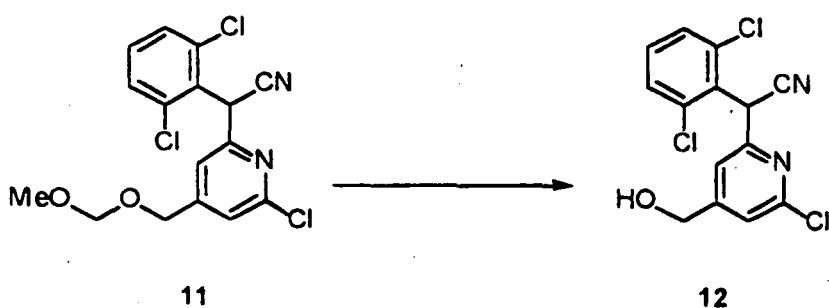
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[0092] One equivalent of potassium t-butoxide was added to a solution of one equivalent of 2,6-dichlorophenyl acetonitrile in THF at room temperature. The mixture was stirred at room temperature for thirty minutes, and a solution of the dichloropyridine **10** in THF was added. After stirring for 1.5 hours, the mixture was poured into aqueous ammonium chloride and extracted with ethyl acetate. The extract was dried and evaporated in vacuo. The residue was purified by flash chromatography to afford **11** in 79% yield as a white powder.

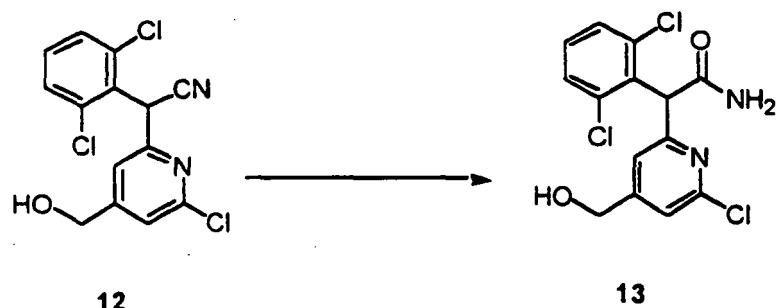
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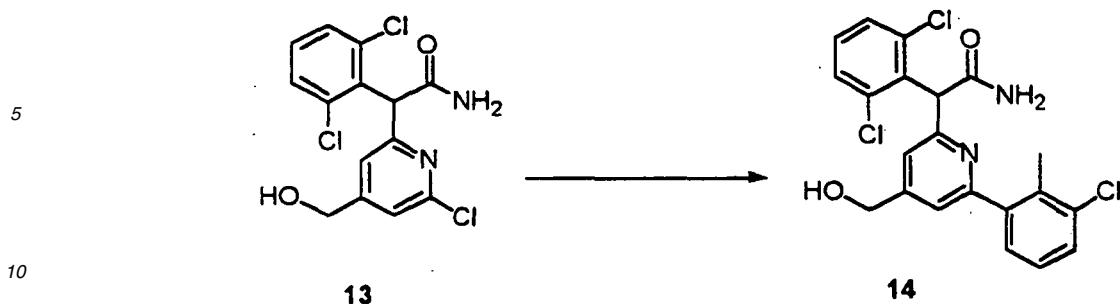
[0093] The acetal **11** was mixed with concentrated hydrochloric acid and stirred for several hours. The mixture was extracted with a water-immiscible organic solvent. The extract was washed with saturated aqueous NaHCO₃, dried, and evaporated in vacuo to afford **12**.

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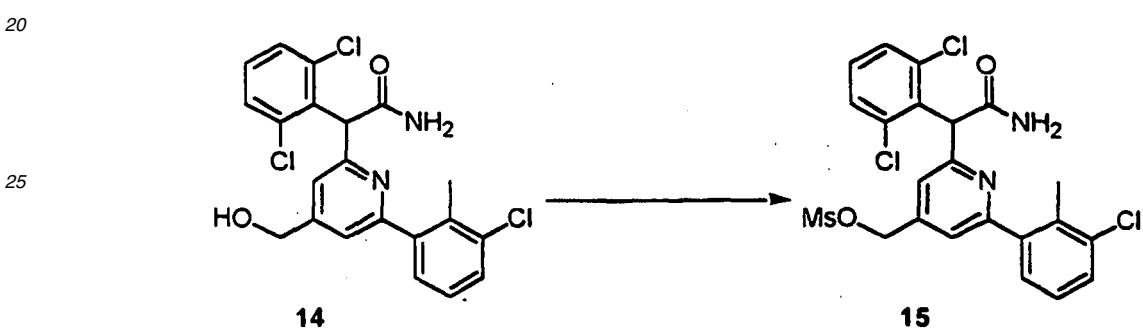


50 [0094] The nitrile **12** was mixed with concentrated sulfuric acid and heated to 100°C for several minutes. The mixture was cooled, poured onto ice, and filtered to afford **13**.

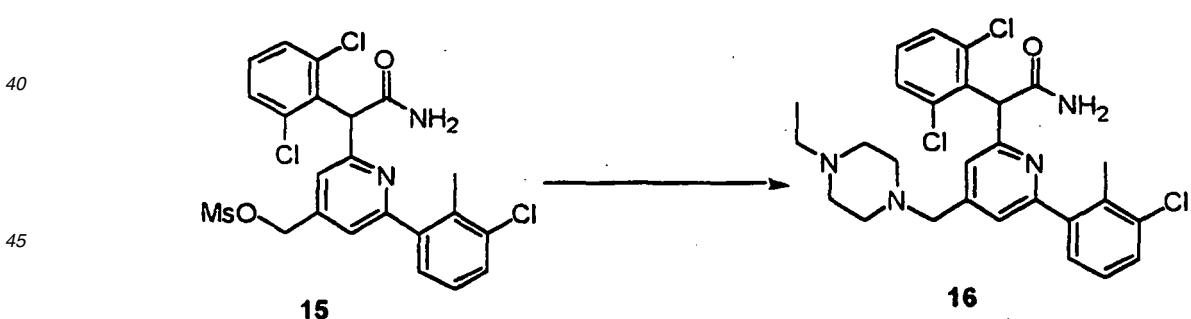
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15 [0095] One equivalent of the chloropyridine **13** was dissolved in 1,2-dimethoxyethane. One equivalent of 3-chloro-2-methylphenylboronic acid was added. A solution of one equivalent of sodium carbonate in water was added along with a catalytic amount of tetrakis (triphenylphosphine) palladium (0). The mixture was heated to 80°C for several hours. The mixture was poured into water and extracted with a water-immiscible organic solvent. The extract was dried, evaporated in vacuo and purified by flash chromatography to afford **14**.



35 [0096] One equivalent of the alcohol **14** was dissolved in THF. The solution was cooled to 0°C and one equivalent of methanesulfonyl chloride was added following by one equivalent of triethylamine. The solution was stirred for several hours, poured into water, and extracted with a water-immiscible solvent. The extract was dried and evaporated in vacuo to afford the crude mesylate **15**.



50 [0097] One equivalent of the methanesulfonyl ester **15** was dissolved in THF. The solution was cooled to 0°C and one equivalent of N-ethyl piperazine was added following by one equivalent of triethylamine. The solution was stirred for several hours, poured into water, and extracted with a water-immiscible solvent. The extract was dried, evaporated, and purified by flash chromatography to afford the pure amine **16**.

55 [0098] The spectral data for reference compound **16** is:

¹H NMR (500 MHz, CDCl₃) δ 9.85 (br s, 1H), 7.97 (dd, 1H), 7.42 (d, 1H), 7.27 (m, 5H), 6.75 (s, 1H), 5.95 (s, 1H), 5.7 (br s, 1H), 3.5 (ABq, 2H), 2.5-2.3 (m, 10H), 2.3 (s, 3H), 1.2 (t, 3H).

EXAMPLE 2Cloning of p38 Kinase in Insect Cells

5 [0099] Two splice variants of human p38 kinase, CSBP1 and CSBP2, have been identified. Specific oligonucleotide primers were used to amplify the coding region of CSBP2 cDNA using a HeLa cell library (Stratagene) as a template. The polymerase chain reaction product was cloned into the pET-15b vector (Novagen). The baculovirus transfer vector, pVL-(His)6-p38 was constructed by subcloning a *Xba*I-*Bam*H I fragment of pET15b-(His) 6-p38 into the complementary sites in plasmid pVL1392 (Pharmingen).

10 [0100] The plasmid pVL-(His)5-p38 directed the synthesis of a recombinant protein consisting of a 23-residue peptide (MGSSHHHHHSSGLVPRGSHMLE, where LVPRGS represents a thrombin cleavage site) fused in frame to the N-terminus of p38, as confirmed by DNA sequencing and by N-terminal sequencing of the expressed protein. Monolayer culture of *Spodoptera frugiperda* (Sf9) insect cells (ATCC) was maintained in TNM-FH medium (Gibco BRL) supplemented with 10% fetal bovine serum in a T-flask at 27°C. Sf9 cells in log phase were co-transfected with linear viral

15 DNA of *Autographa californica* nuclear polyhedrosis virus (Pharmingen) and transfer vector pVL-(His)6-p38 using Lipofectin (Invitrogen). The individual recombinant baculovirus clones were purified by plaque assay using 1% low melting agarose.

EXAMPLE 3Expression and Purification of Recombinant p38 Kinase

20 [0101] *Trichoplusia ni* (Tn-368) High-Five™ cells (Invitrogen) were grown in suspension in Excel-405 protein free medium (JRH Bioscience) in a shaker flask at 27°C. Cells at a density of 1.5 X 10⁶ cells/ml were infected with the recombinant baculovirus described above at a multiplicity of infection of 5. The expression level of recombinant p38 was monitored by immunoblotting using a rabbit anti-p38 antibody (Santa Cruz Biotechnology). The cell mass was harvested 72 hours after infection when the expression level of p38 reached its maximum.

25 [0102] Frozen cell paste from cells expressing the (His)₆-tagged p38 was thawed in 5 volumes of Buffer A (50 mM NaH₂PO₄ pH 8.0, 200 mM NaCl, 2 mM β-Mercaptoethanol, 10% Glycerol and 0.2 mM PMSF). After mechanical disruption of the cells in a microfluidizer, the lysate was centrifuged at 30,000 x g for 30 minutes. The supernatant was incubated batchwise for 3-5 hours at 4°C with Talon™ (Clontech) metal affinity resin at a ratio of 1 ml of resin per 2-4 mgs of expected p38. The resin was settled by centrifugation at 500 x g for 5 minutes and gently washed batchwise with Buffer A. The resin was slurried and poured into a column (approx. 2.6 x 5.0 cm) and washed with Buffer A + 5 mM imidazole.

30 [0103] The (His)₆-p38 was eluted with Buffer A + 100 mM imidazole and subsequently dialyzed overnight at 4°C against 2 liters of Buffer B, (50 mM HEPES, pH 7.5, 25 mM β-glycerophosphate, 5% glycerol, 2 mM DTT). The His₆ tag was removed by addition of at 1.5 units thrombin (Calbiochem) per mg of p38 and incubation at 20°C for 2-3 hours. The thrombin was quenched by addition of 0.2 mM PMSF and then the entire sample was loaded onto a 2 ml benzamidine agarose (American International Chemical) column.

35 [0104] The flow through fraction was directly loaded onto a 2.6 x 5.0 cm Q-Sepharose (Pharmacia) column previously equilibrated in Buffer B + 0.2 mM PMSF. The p38 was eluted with a 20 column volume linear gradient to 0.6M NaCl in Buffer B. The eluted protein peak was pooled and dialyzed overnight at 4°C vs. Buffer C (50 mM HEPES pH 7.5, 5% glycerol, 50 mM NaCl, 2 mM DTT, 0.2 mM PMSF).

40 [0105] The dialyzed protein was concentrated in a Centriprep (Amicon) to 3-4 ml and applied to a 2.6 x 100 cm Sephadryl S-100HR (Pharmacia) column. The protein was eluted at a flow rate of 35 ml/hr. The main peak was pooled, adjusted to 20 mM DTT, concentrated to 10-80 mgs/ml and frozen in aliquots at -70°C or used immediately.

EXAMPLE 4Activation of p38

50 [0106] p38 was activated by combining 0.5 mg/ml p38 with 0.005 mg/ml DD-double mutant MKK6 in Buffer B + 10 mM MgCl₂, 2 mM ATP, 0.2 mM Na₂VO₄ for 30 minutes at 20°C. The activation mixture was then loaded onto a 1.0 x 10 cm MonoQ column (Pharmacia) and eluted with a linear 20 column volume gradient to 1.0 M NaCl in Buffer B. The activated p38 eluted after the ADP and ATP. The activated p38 peak was pooled and dialyzed against buffer B + 0.2 mM Na₂VO₄ to remove the NaCl. The dialyzed protein was adjusted to 1.1 M potassium phosphate by addition of a 4.0 M stock solution and loaded onto a 1.0 x 10 cm HIC (Rainin Hydorpore) column previously equilibrated in Buffer D (10% glycerol, 20 mM β-glycerophosphate, 2.0 mM DTT) + 1.1 M K₂HPO₄. The protein was eluted with a 20 column volume linear gradient to Buffer D + 50 mM K₂HPO₄. The double phosphorylated p38 eluted as the main peak and was pooled for dialysis against

Buffer B + 0.2mM Na₂VO₄. The activated p38 was stored at -70°C.

EXAMPLE 5

5 p38 Inhibition Assays

A. Inhibition of Phosphorylation of EGF Receptor Peptide

[0107] This assay was carried out in the presence of 10 mM MgCl₂, 25 mM β-glycerophosphate, 10% glycerol and 100 mM HEPES buffer at pH 7.6. For a typical IC₅₀ determination, a stock solution was prepared containing all of the above components and activated p38 (5 nM). The stock solution was aliquotted into vials. A fixed volume of DMSO or inhibitor in DMSO (final concentration of DMSO in reaction was 5%) was introduced to each vial, mixed and incubated for 15 minutes at room temperature. EGF receptor peptide, KRELVEPLTPSGEAPNQALLR, a phosphoryl acceptor in p38-catalyzed kinase reaction (1), was added to each vial to a final concentration of 200 μM. The kinase reaction was initiated with ATP (100 μM) and the vials were incubated at 30°C. After 30 minutes, the reactions were quenched with equal volume of 10% trifluoroacetic acid (TFA).

[0108] The phosphorylated peptide was quantified by HPLC analysis. Separation of phosphorylated peptide from the unphosphorylated peptide was achieved on a reverse phase column (Deltapak, 5 μm, C18 100D, Part no. 011795) with a binary gradient of water and acetonitrile, each containing 0.1% TFA. IC₅₀ (concentration of inhibitor yielding 50% inhibition) was determined by plotting the percent (%) activity remaining against inhibitor concentration.

B. Inhibition of ATPase Activity

[0109] This assay is carried out in the presence of 10 mM MgCl₂, 25 mM β-glycerophosphate, 10% glycerol and 100 mM HEPES buffer at pH 7.6. For a typical Ki determination, the Km for ATP in the ATPase activity of activated p38 reaction is determined in the absence of inhibitor and in the presence of two concentrations of inhibitor. A stock solution is prepared containing all of the above components and activated p38 (60 nM). The stock solution is aliquotted into vials. A fixed volume of DMSO or inhibitor in DMSO (final concentration of DMSO in reaction was 2.5%) is introduced to each vial, mixed and incubated for 15 minutes at room temperature. The reaction is initiated by adding various concentrations of ATP and then incubated at 30°C. After 30 minutes, the reactions are quenched with 50 μl of EDTA (0.1 M, final concentration), pH 8.0. The product of p38 ATPase activity, ADP, is quantified by HPLC analysis.

[0110] Separation of ADP from ATP is achieved on a reversed phase column (Supelcosil, LC-18, 3 μm, part no. 5-8985) using a binary solvent gradient of following composition: Solvent A - 0.1 M phosphate buffer containing 8 mM tetrabutylammonium hydrogen sulfate (Sigma Chemical Co., catalogue no. T-7158), Solvent B - Solvent A with 30% methanol.

[0111] Ki is determined from the rate data as a function of inhibitor and ATP concentrations.

[0112] p38 inhibitors of this invention will inhibit the ATPase activity of p38.

C. Inhibition of IL-1, TNF, IL-6 and IL-8 Production in LPS-Stimulated PBMCs

[0113] Inhibitors were serially diluted in DMSO from a 20 mM stock. At least 6 serial dilutions were prepared. Then 4x inhibitor stocks were prepared by adding 4 μl of an inhibitor dilution to 1 ml of RPMI1640 medium/10% fetal bovine serum. The 4x inhibitor stocks contained inhibitor at concentrations of 80 μM, 32 μM, 12.8 μM, 5.12 μM, 2.048 μM, 0.819 μM, 0.328 μM, 0.131 μM, 0.052 μM, 0.021 μM etc. The 4x inhibitor stocks were prewarmed at 37°C until use.

[0114] Fresh human blood buffy cells were separated from other cells in a Vacutainer CPT from Becton & Dickinson (containing 4 ml blood and enough DPBS without Mg²⁺/Ca²⁺ to fill the tube) by centrifugation at 1500 x g for 15 min. Peripheral blood mononuclear cells (PBMCs), located on top of the gradient in the Vacutainer, were removed and washed twice with RPMI1640 medium/10% fetal bovine serum. PBMCs were collected by centrifugation at 500 x g for 10 min. The total cell number was determined using a Neubauer Cell Chamber and the cells were adjusted to a concentration of 4.8 x 10⁶ cells/ml in cell culture medium (RPMI1640 supplemented with 10% fetal bovine serum).

[0115] Alternatively, whole blood containing an anticoagulant was used directly in the assay.

[0116] 100 μl of cell suspension or whole blood were placed in each well of a 96-well cell culture plate. Then 50 μl of the 4x inhibitor stock was added to the cells. Finally, 50 μl of a lipopolysaccharide (LPS) working stock solution (16 ng/ml in cell culture medium) was added to give a final concentration of 4 ng/ml LPS in the assay. The total assay volume of the vehicle control was also adjusted to 200 μl by adding 50 μl cell culture medium. The PBMC cells or whole blood were then incubated overnight (for 12-15 hours) at 37°C/5% CO₂ in a humidified atmosphere.

[0117] The next day the cells were mixed on a shaker for 3-5 minutes before centrifugation at 500 x g for 5 minutes. Cell culture supernatants were harvested and analyzed by ELISA for levels of IL-1b (R & D Systems, Quantikine kits,

#DBL50), TNF- α (BioSource, #KHC3012), IL-6 (Endogen, #EH2-IL6) and IL-8 (Endogen, #EH2-IL8) according to the instructions of the manufacturer. The ELISA data were used to generate dose-response curves from which IC50 values were derived.

[0118] Results for the kinase assay ("kinase"; subsection A, above), IL-1 and TNF in LPS-stimulated PBMCs ("cell") and IL-1, TNF and IL-6 in whole blood ("WB") for various p38 inhibitors of this invention are shown in Table 7 below:

Table 7.

Compound.	M.W.	Kinase IC50 (uM)	Cell IL-1 IC50 (uM)	Cell TNF IC50 (uM)	WB IL-1 IC50 (uM)	WB TNF IC50 (uM)	WB IL-6 IC50 (uM)
17	402.28	0.056	0.021	0.14	0.42	0.064	0.25
18	436.32	0.002	0.02	0.05	0.118	0.055	0.18
19	387.36	0.027	0.027	0.01	0.057	0.09	0.075

[0119] Other p38 inhibitors of this invention will also inhibit phosphorylation of EGF receptor peptide, and will inhibit the production of IL-1, TNF and IL-6, as well as IL-8, in LPS-stimulated PBMCs or in whole blood.

D. Inhibition of IL-6 and IL-8 Production in IL-1-Stimulated PBMCs

[0120] This assay is carried out on PBMCs exactly the same as above except that 50 μ l of an IL-1b working stock solution (2 ng/ml in cell culture medium) is added to the assay instead of the (LPS) working stock solution.

[0121] Cell culture supernatants are harvested as described above and analyzed by ELISA for levels of IL-6 (Endogen, #EH2-IL6) and IL-8 (Endogen, #EH2-IL8) according to the instructions of the manufacturer. The ELISA data are used to generate dose-response curves from which IC50 values were derived.

E. Inhibition of LPS-Induced Prostaglandin Endoperoxide Synthase-2 (PGHS-2, or COX-2) Induction in PBMCs

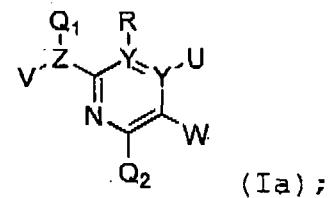
[0122] Human peripheral mononuclear cells (PBMCs) are isolated from fresh human blood buffy coats by centrifugation in a Vacutainer CPT (Becton & Dickinson). 15 \times 10⁶ cells are seeded in a 6-well tissue culture dish containing RPMI 1640 supplemented with 10% fetal bovine serum, 50U/ml penicillin, 50 μ g/ml streptomycin, and 2 mM L-glutamine. Compounds are added at 0.2, 2.0 and 20 μ M final concentrations in DMSO. LPS is then added at a final concentration of 4 ng/ml to induce enzyme expression. The final culture volume is 10 ml/well.

[0123] After overnight incubation at 37°C, 5% CO₂, the cells are harvested by scraping and subsequent centrifugation, the supernatant is removed, and the cells are washed twice in ice-cold DPBS (Dulbecco's phosphate buffered saline, BioWhittaker). The cells are lysed on ice for 10 min in 50 μ l cold lysis buffer (20 mM Tris-HCl, pH 7.2, 150 mM NaCl, 1% Triton-X-100, 1% deoxycholic acid, 0.1% SDS, 1 mM EDTA, 2% aprotinin (Sigma), 10 μ g/ml pepstatin, 10 μ g/ml leupeptin, 2 mM PMSF, 1 mM benzamidine, 1 mM DTT) containing 1 μ l Benzonase (DNase from Merck). The protein concentration of each sample is determined using the BCA assay (Pierce) and bovine serum albumin as a standard. Then the protein concentration of each sample is adjusted to 1 mg/ml with cold lysis buffer. To 100 μ l lysate an equal volume of 2xSDS PAGE loading buffer is added and the sample is boiled for 5 min. Proteins (30 μ g/lane) are size-fractionated on 4-20% SDS PAGE gradient gels (Novex) and subsequently transferred onto nitrocellulose membrane by electrophoretic means for 2 hours at 100 mA in Towbin transfer buffer (25 mM Tris, 192 mM glycine) containing 20% methanol. After transfer, the membrane is pretreated for 1 hour at room temperature with blocking buffer (5% non-fat dry milk in DPBS supplemented with 0.1% Tween-20) and washed 3 times in DPBS/0.1% Tween-20. The membrane is incubated overnight at 4°C with a 1: 250 dilution of monoclonal anti-COX-2 antibody (Transduction Laboratories) in blocking buffer. After 3 washes in DPBS/0.1% Tween-20, the membrane is incubated with a 1:1000 dilution of horseradish peroxidase-conjugated sheep antiserum to mouse Ig (Amersham) in blocking buffer for 1 h at room temperature. Then the membrane is washed again 3 times in DPBS/0.1% Tween-20. An ECL detection system (SuperSignal™ CL-HRP Substrate System, Pierce) is used to determine the levels of expression of COX-2.

[0124] While we have hereinbefore presented a number of embodiments of this invention, it is apparent that our basic construction can be altered to provide other embodiments which utilize the methods of this invention.

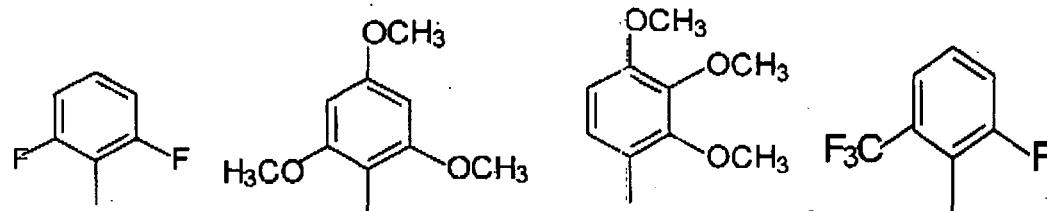
Claims

1. A compound of the formula:

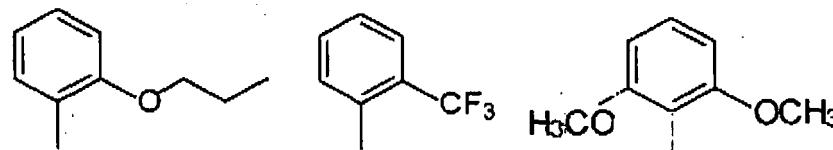


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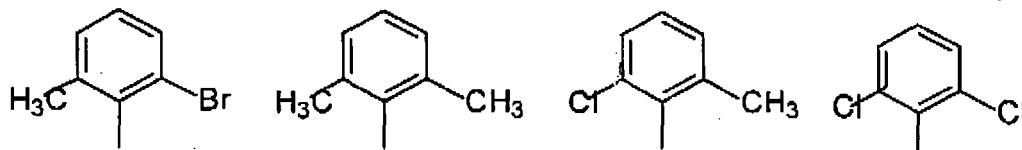
wherein Q_1 is selected from:



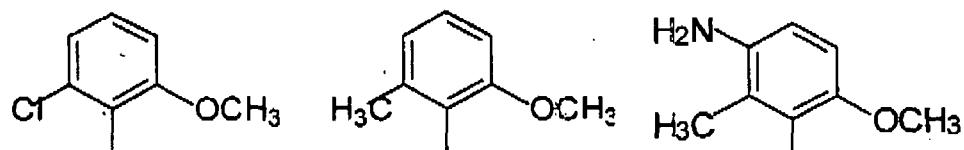
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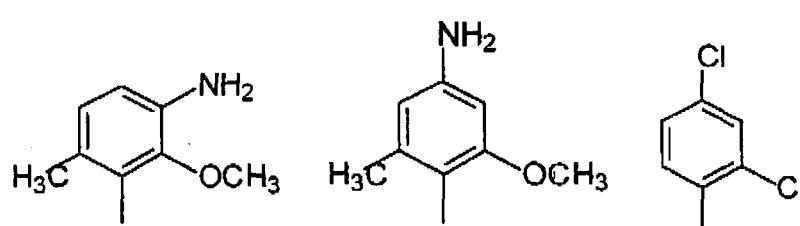
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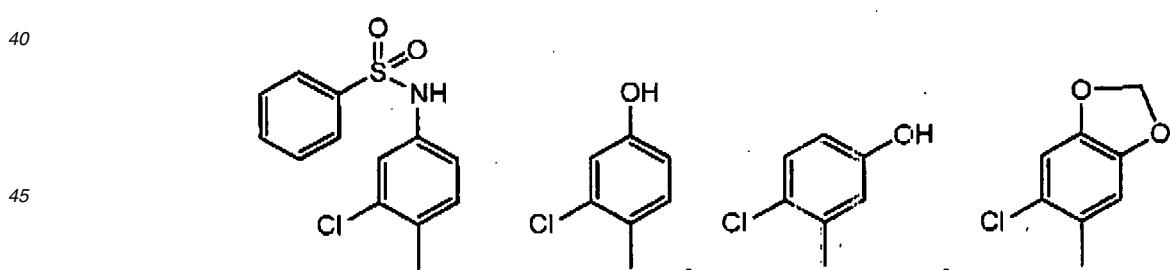
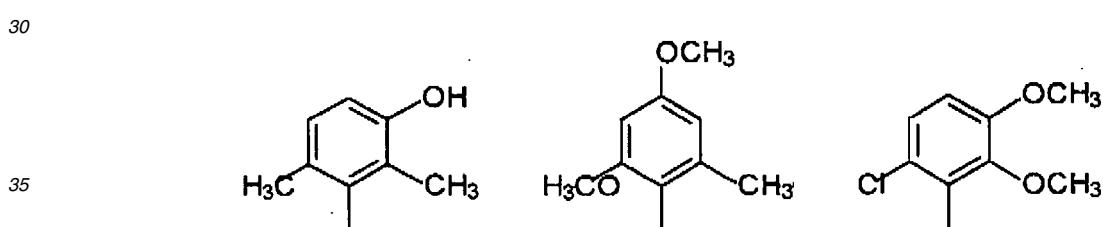
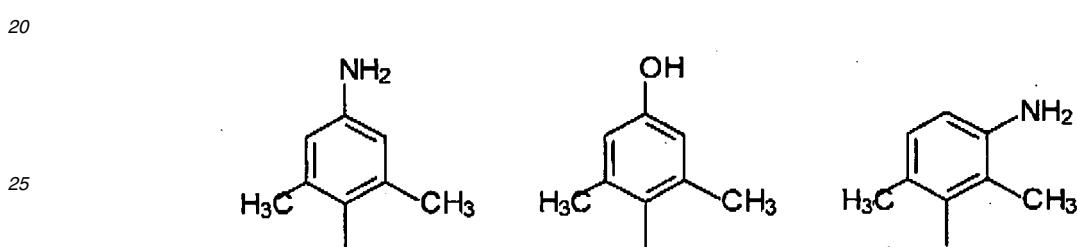
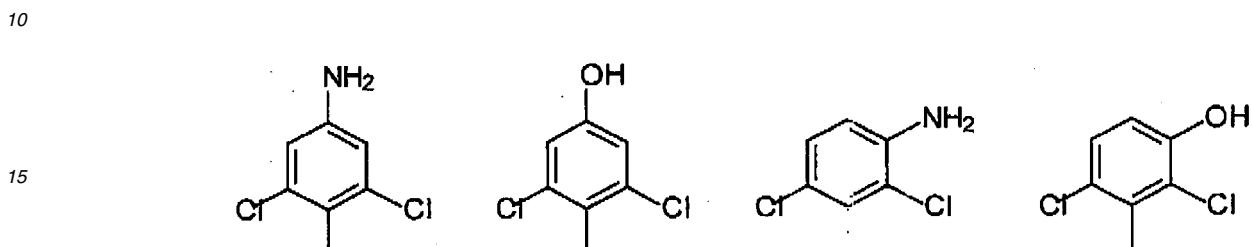
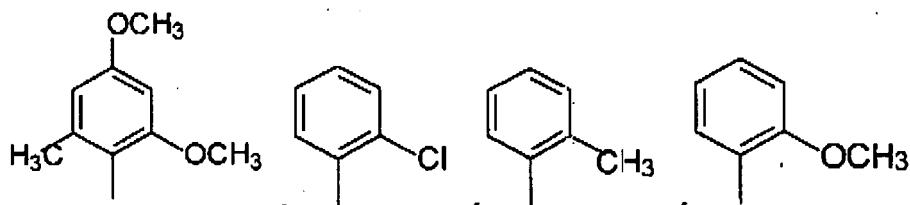
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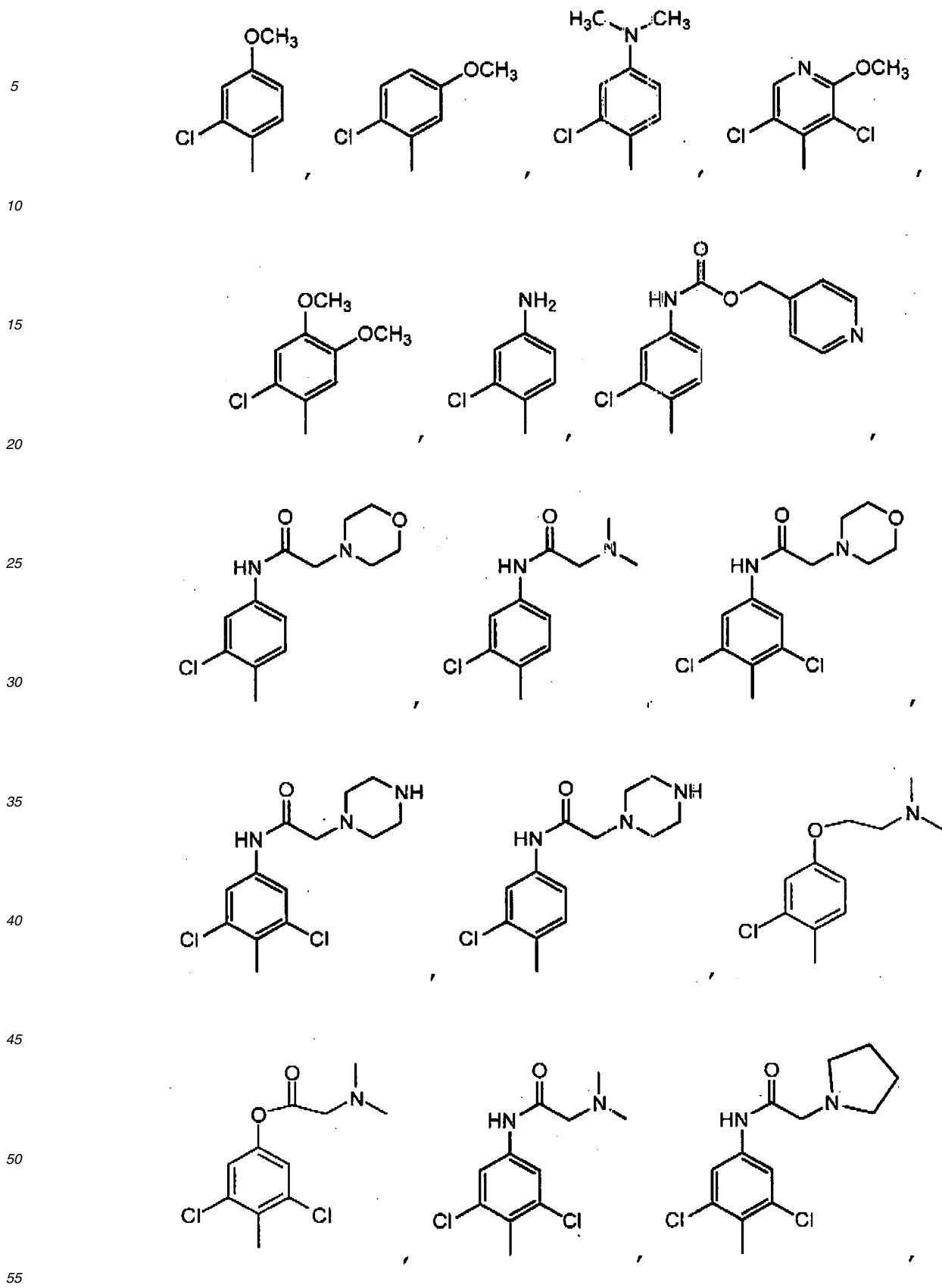


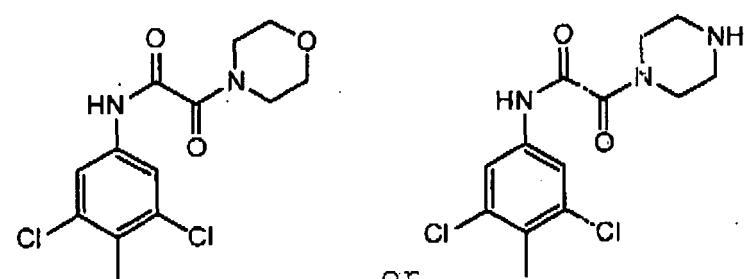
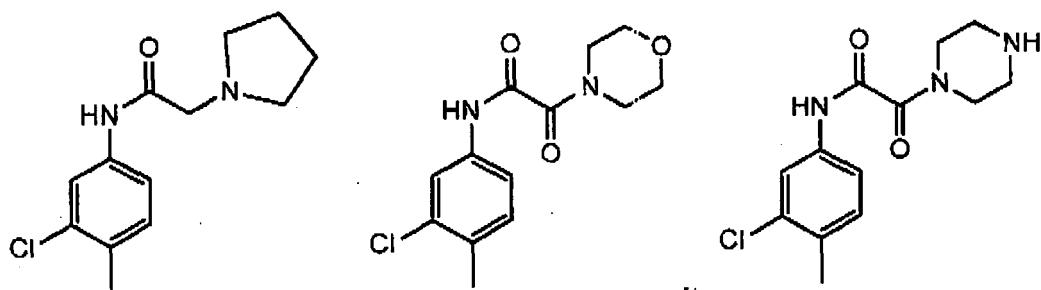
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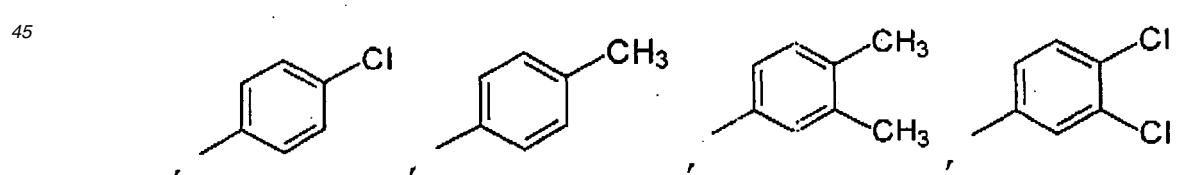
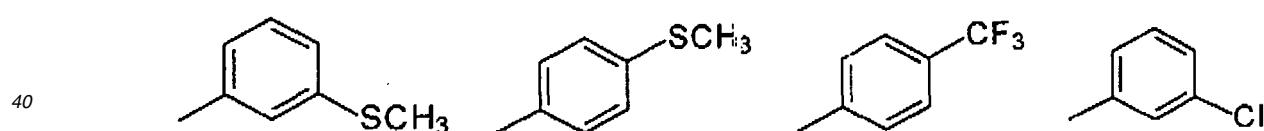
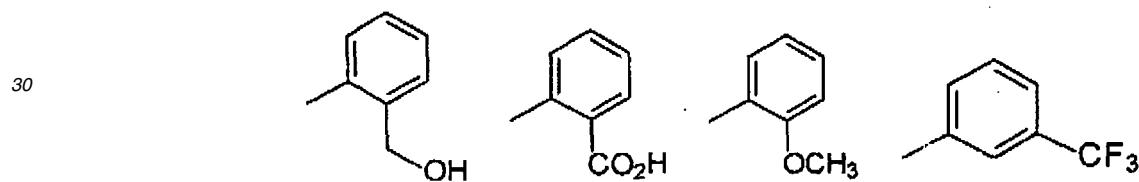
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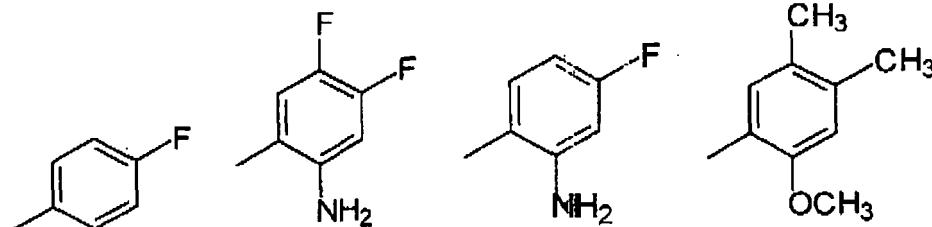


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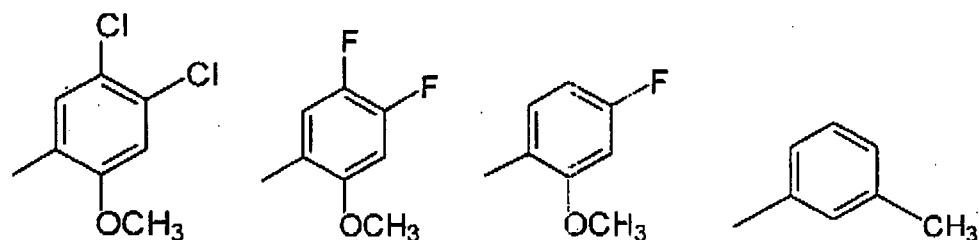
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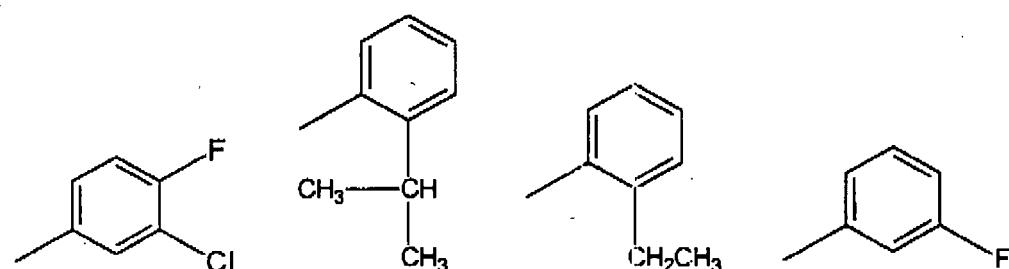


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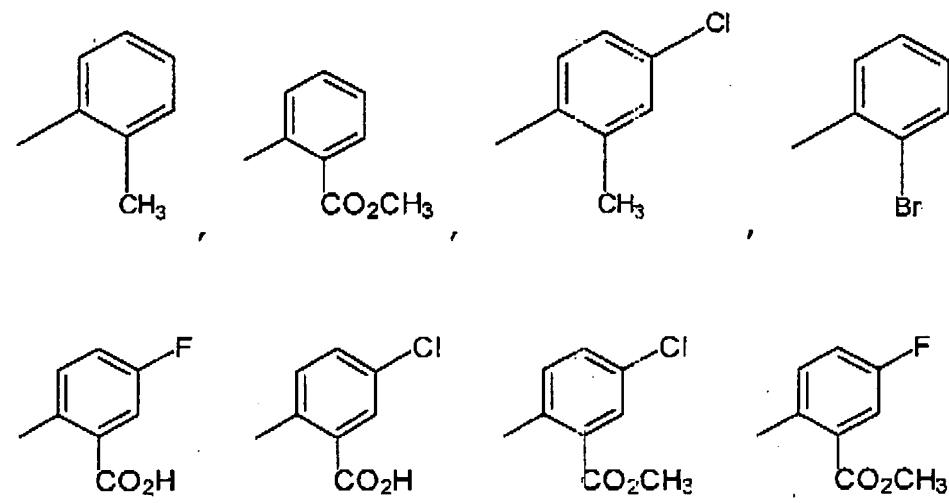
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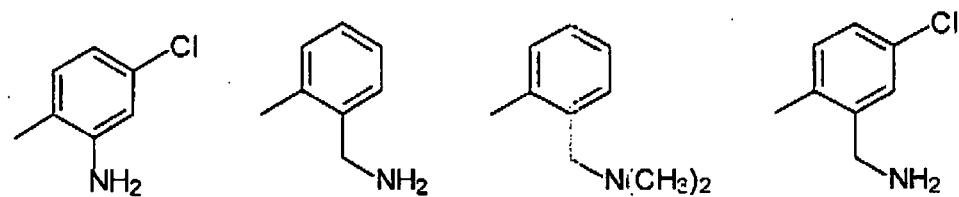


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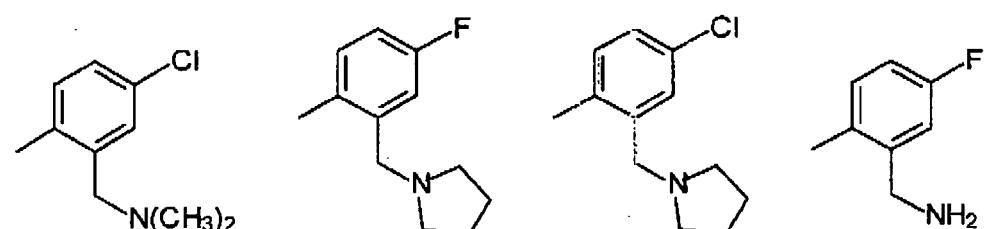
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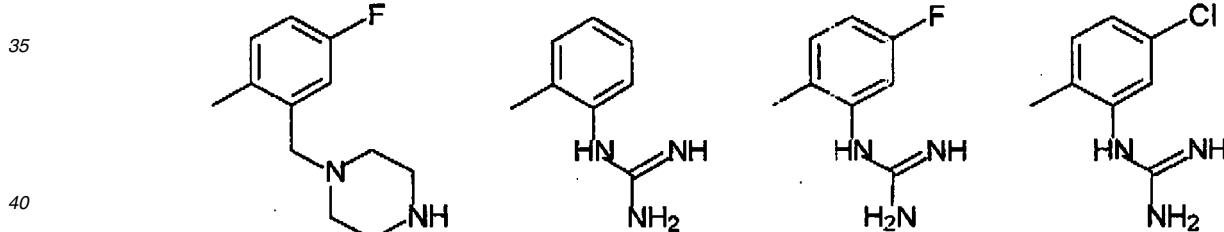
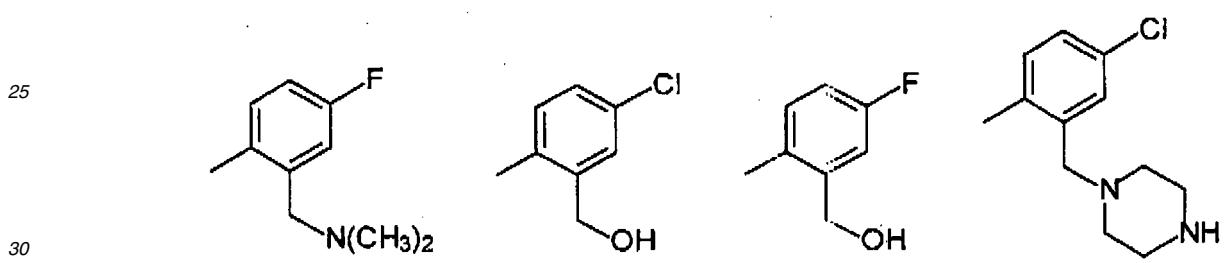




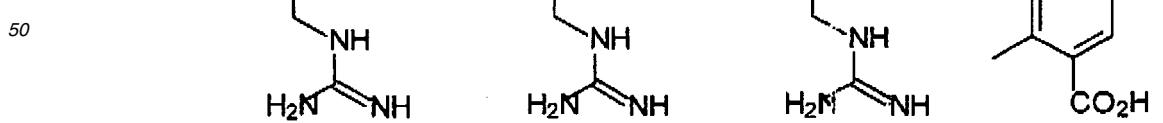
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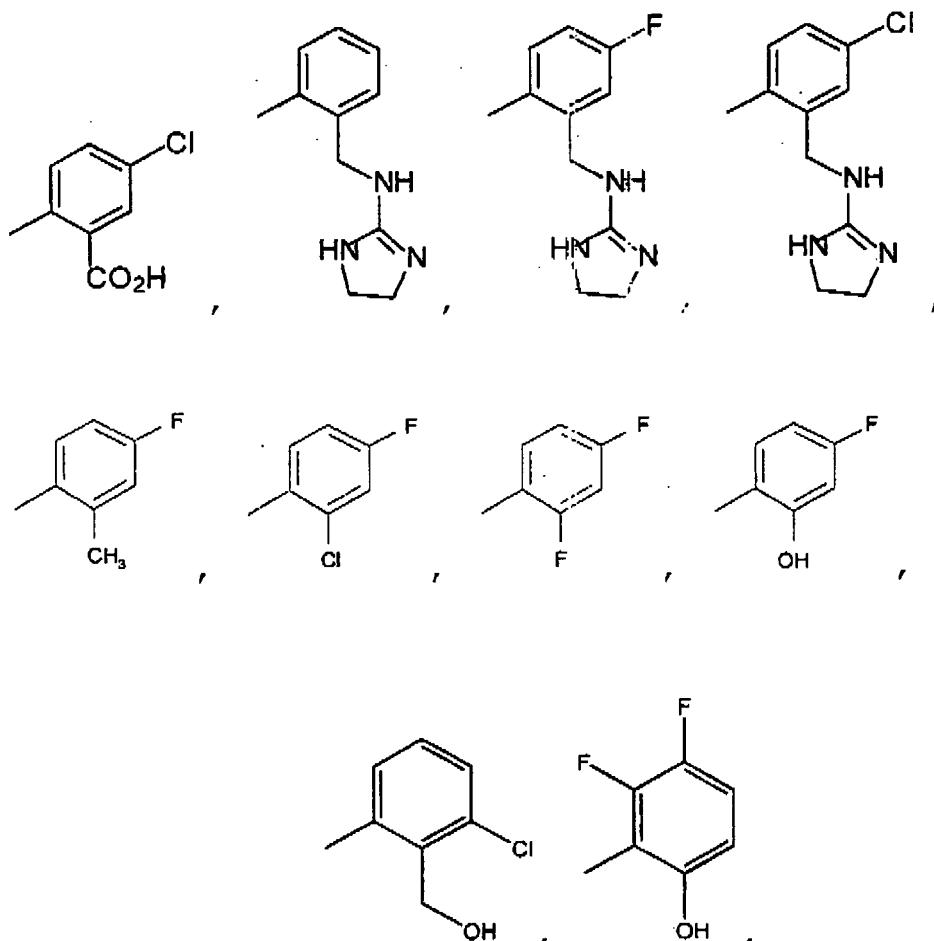
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unsubstituted 2-pyridyl or unsubstituted phenyl;

35 R' is selected from hydrogen; (C₁-C₃)-alkyl; (C₂-C₃)-alkenyl or alkynyl; phenyl or phenyl substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl; or a 5-6 membered heterocyclic ring system optionally substituted with 1 to 3 substituents independently selected from halo, methoxy, cyano, nitro, amino, hydroxy, methyl or ethyl;

40 R³ is selected from 5-8 membered aromatic or non-aromatic carbocyclic or heterocyclic ring systems;

45 W is selected from N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; N(R²)₂C(O)-R²; CH(OH)-R²; C(O)-N(R²)₂; C(O)-OR²; or (C₁-C₄) straight or branched alkyl optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, R³, or SO₂N(R²)₂; or a 5-6 membered carbocyclic or heterocyclic ring system optionally substituted with N(R')₂, OR', CO₂R', CON(R')₂, or SO₂N(R²)₂; provided that W is not an R³ substituted C₁ alkyl;

50 R² is selected from hydrogen, (C₁-C₃)-alkyl, or (C₁-C₃)-alkenyl; each optionally substituted with -N(R')₂, -OR', SR', -C(O)-N(R')₂, -S(O₂)-N(R')₂, -C(O)-OR';

each Y is C, wherein each R and U attached to Y is independently selected from hydrogen or methyl;

Z is CH or N; and

V is -C(O)NH₂.

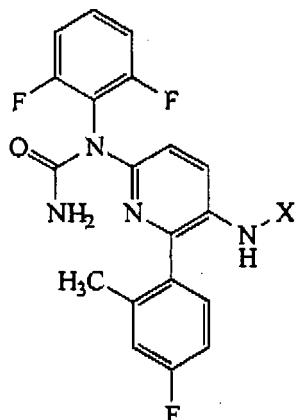
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2. The compound according to claim 1, wherein Q₁ is selected from 2-fluoro-6-trifluoromethylphenyl, 2,6-difluorophenyl, 2,6-dichlorophenyl, 2-chloro-4-hydroxyphenyl, 2-chloro-4-aminophenyl, 2,6-dichloro-4-aminophenyl, 2,6-dichloro-3-aminophenyl, 2,6-dimethyl-4-hydroxyphenyl, 2-methoxy-3,5-dichloro-4-pyridyl, 2-chloro-4,5-methylenedioxyphenyl, or 2-chloro-4-(N-2-morpholino-acetamido)phenyl.
3. The compound according to claim 1, wherein Q₂ is selected from phenyl, 2-isopropylphenyl, 3,4-dimethylphenyl, 2-ethylphenyl, 3-fluorophenyl, 2-methylphenyl, 3-chloro-4-fluorophenyl, 3-chlorophenyl, 2-carbomethoxyphenyl, 2-carboxyphenyl, 2-methyl-4-chlorophenyl, 2-bromophenyl, 2-pyridyl, 2-methylenehydroxyphenyl, 4-fluorophenyl, 2-

10 methyl-4-fluorophenyl, 2-chloro-4-fluorophenyl, 2,4-difluorophenyl, 2-hydroxy-4-fluorophenyl, 2-methylenehydroxy-
4-fluorophenyl, or 3-chloro-2-methylenehydroxyphenyl.

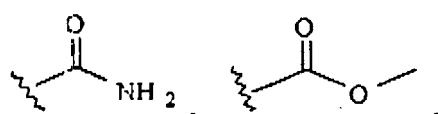
15 4. The compound according to claim 1, wherein the compound is

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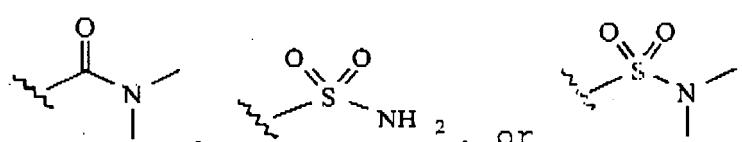


25 and X is selected from H,

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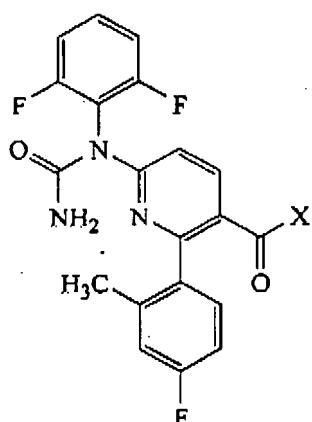


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40 5. The compound according to claim 1, wherein the compound is

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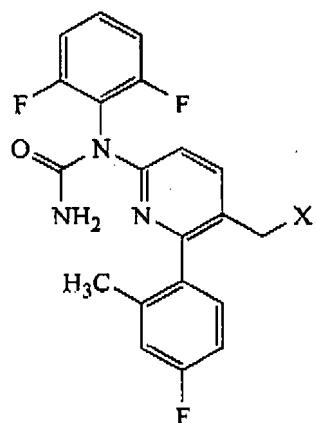
and X is selected from NH₂ or N(CH₃)₂.

6. The compound according to claim 1, wherein the compound is

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and X is selected from OH, NH₂, or N(CH₃)₂.

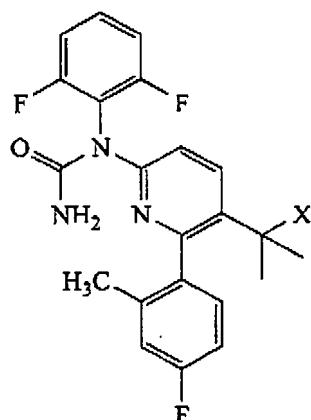
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7. The compound according to claim 1, wherein the compound is

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and X is selected from OH, NH₂, or N(CH₃)₂.

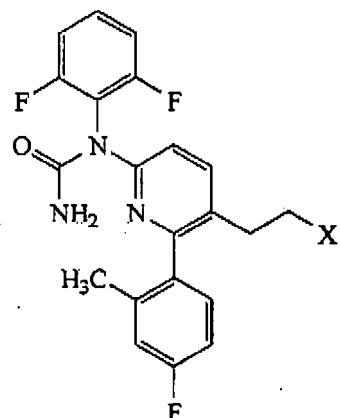
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8. The compound according to claim 1, wherein the compound is

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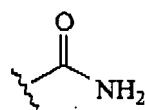
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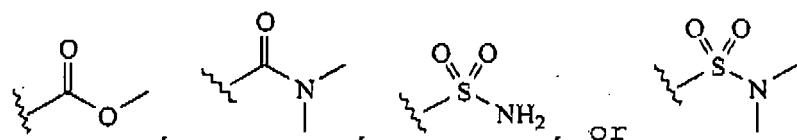


and X is selected from OH, NH₂, N(CH₃)₂,

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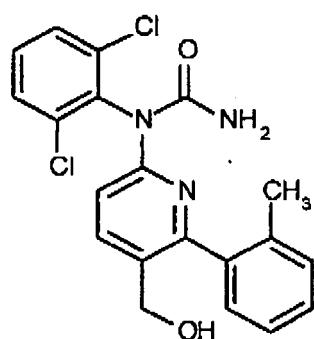
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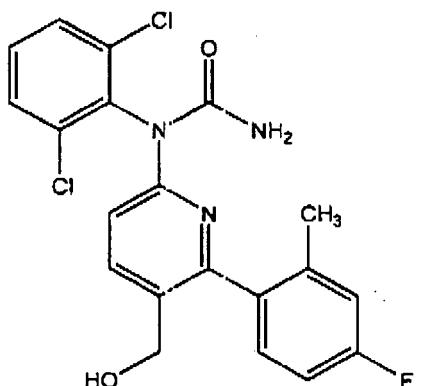
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9. The compound according to claim 1, wherein said compound is selected from any one of

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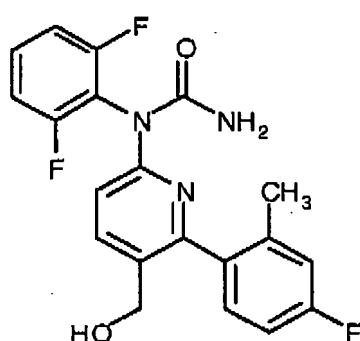
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10. A pharmaceutical composition comprising a compound according to any one of claims 1 to 9, and a pharmaceutically acceptable carrier.

55 11. Use of a compound according to any one of claims 1-10 for the preparation of a pharmaceutical composition for treating or preventing inflammatory diseases, autoimmune diseases, destructive bone disorders, proliferative disorders, infectious diseases, viral diseases, neurodegenerative diseases, allergies, reperfusion/ischemia in stroke or myocardial ischemia, renal ischemia, heart attacks, angiogenic disorders, organ hypoxia, vascular hyperplasia,

cardiac hypertrophy, thrombin-induced platelet aggregation or conditions associated with prostaglandin endoperoxide synthase-2.

5 12. A compound according to any one of claims 1-10 for use in treating or preventing inflammatory diseases, autoimmune diseases, destructive bone disorders, proliferative disorders, infectious diseases, viral diseases, neurodegenerative diseases, allergies, reperfusion/ischemia in stroke or myocardial ischemia, renal ischemia, heart attacks, angiogenic disorders, organ hypoxia, vascular hyperplasia, cardiac hypertrophy, thrombin-induced platelet aggregation or conditions associated with prostaglandin endoperoxide synthase-2.

10 13. The use according to claim 11 or the compound according to claim 12, wherein the inflammatory disease is selected from acute pancreatitis, chronic pancreatitis, asthma, allergies, or adult respiratory distress syndrome.

15 14. The use according to claim 11 or the compound according to claim 12, wherein the autoimmune disease is selected from glomerulonephritis, rheumatoid arthritis, systemic lupus erythematosus, scleroderma, chronic thyroiditis, Graves' disease, autoimmune gastritis, diabetes, autoimmune hemolytic anemia, autoimmune neutropenia, thrombocytopenia, atopic dermatitis, chronic active hepatitis, myasthenia gravis, multiple sclerosis, inflammatory bowel disease, ulcerative colitis, Crohn's disease, psoriasis, or graft vs. host disease.

20 15. The use according to claim 11 or the compound according to claim 12, wherein the destructive bone disorder is selected from osteoarthritis, osteoporosis or multiple myeloma-related bone disorder.

25 16. The use according to claim 11 or the compound according to claim 12, wherein the proliferative disease is selected from acute myelogenous leukemia, chronic myelogenous leukemia, metastatic melanoma, Kaposi's sarcoma, or multiple myeloma.

30 17. The use according to claim 11 or the compound according to claim 12, wherein the infectious disease is selected from sepsis, septic shock, or Shigellosis.

35 18. The use according to claim 11 or the compound according to claim 12, wherein the viral disease is selected from acute hepatitis infection, HIV infection or CMV retinitis.

40 19. The use according to claim 11 or the compound according to claim 12, wherein the neurodegenerative disease is selected from Alzheimer's disease, Parkinson's disease, cerebral ischemia or neurodegenerative disease caused by traumatic injury.

45 20. The use according to claim 11, to treat or prevent or the compound according to claim 12, for use in treating or preventing ischemia/reperfusion in stroke or myocardial ischemia, renal ischemia, heart attacks, organ hypoxia or thrombin-induced platelet aggregation.

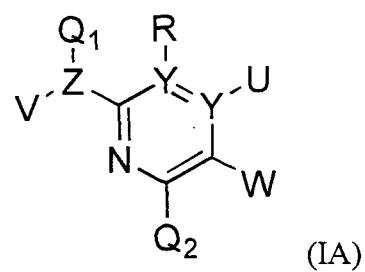
50 21. The use according to claim 11 or the compound according to claim 12, wherein the condition associated with prostaglandin endoperoxide synthase-2 is selected from edema, fever, analgesia or pain.

55 22. The use or the compound according to claim 21, wherein said pain is selected from neuromuscular pain, headache, cancer pain, dental pain or arthritis pain.

45 23. The use according to claim 11 or the compound according to claim 12, wherein the angiogenic disorder is selected from solid tumors, ocular neovascularization, or infantile haemangiomas.

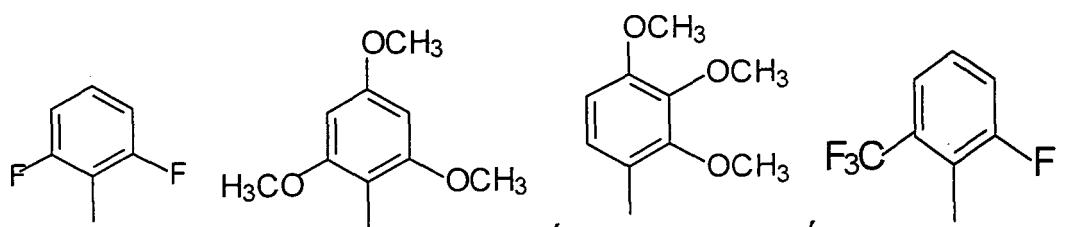
50 **Patentansprüche**

1. Verbindung der Formel:

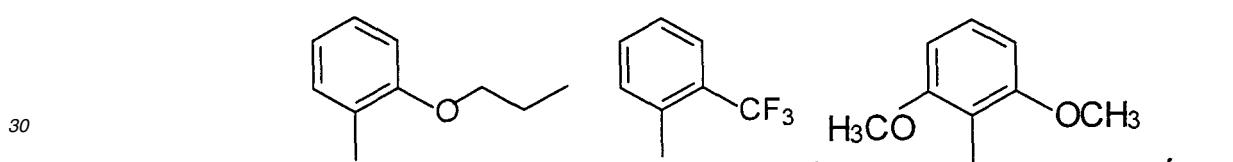


wobei Q_1 ausgewählt ist aus:

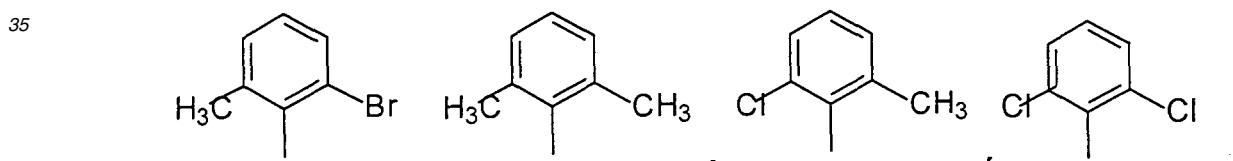
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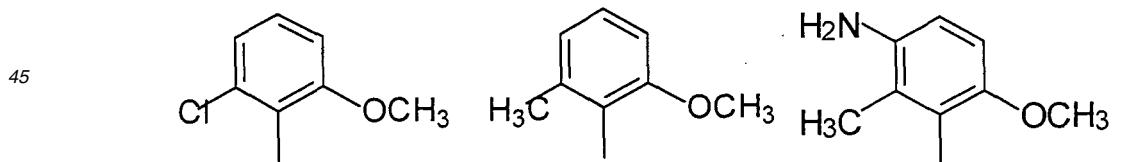
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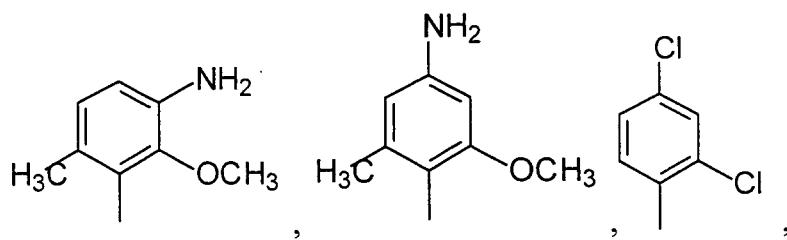


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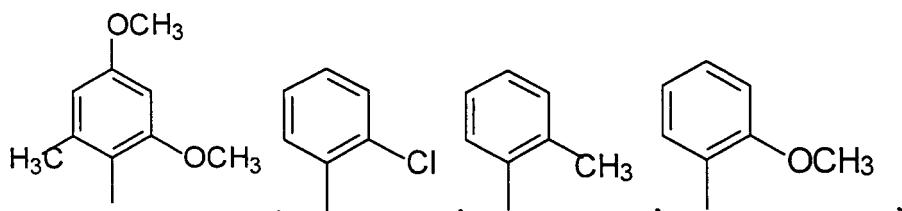
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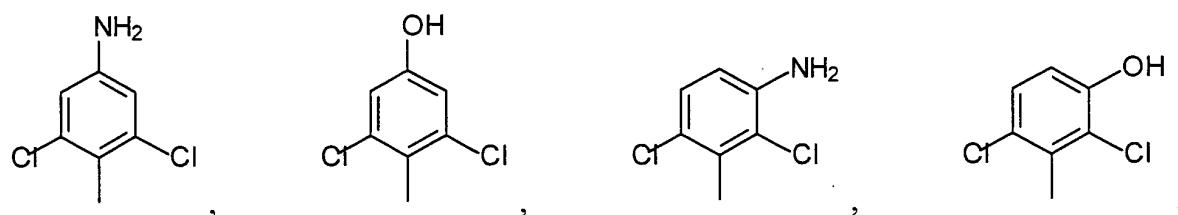
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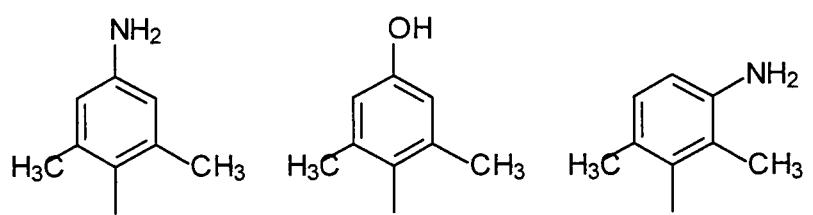
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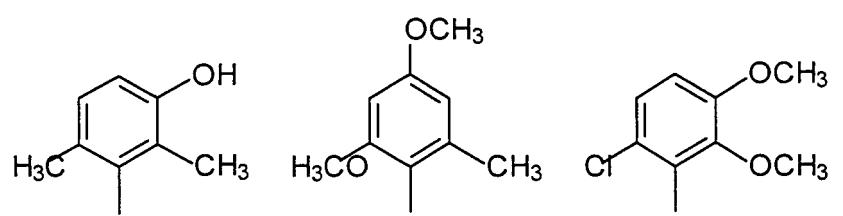
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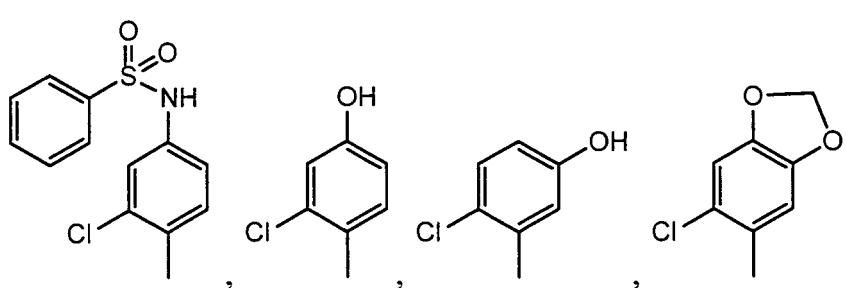
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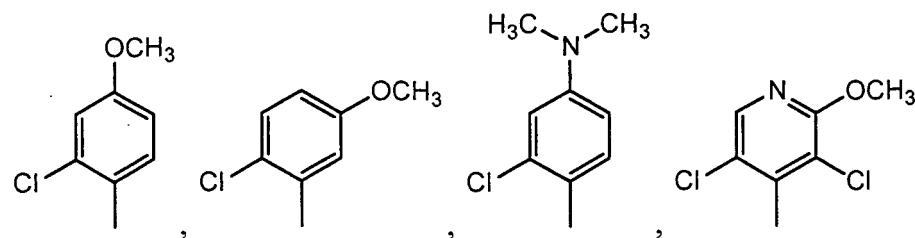
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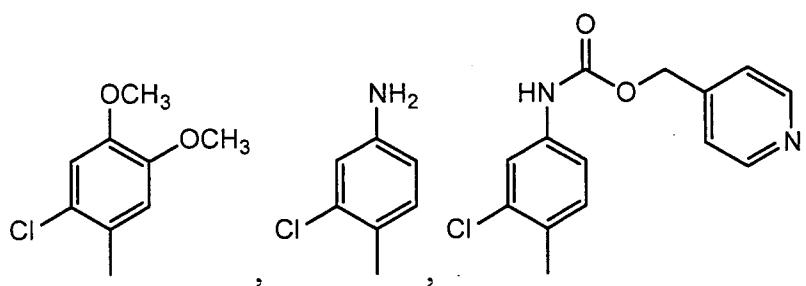
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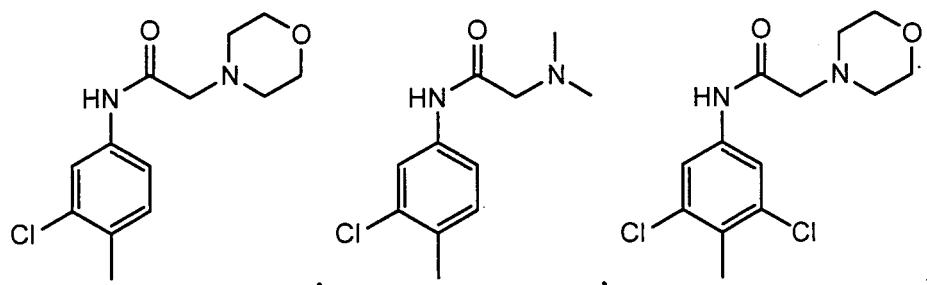




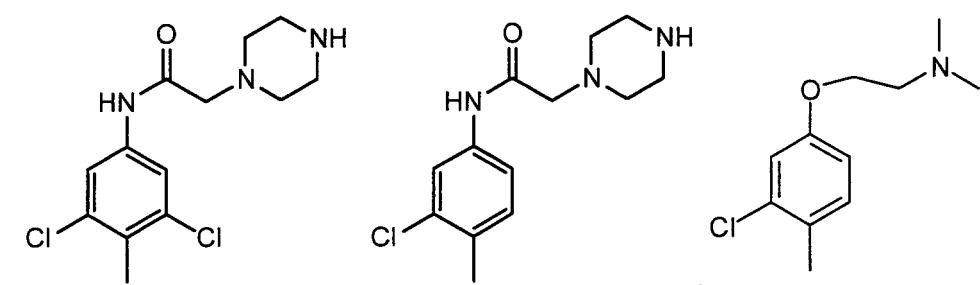
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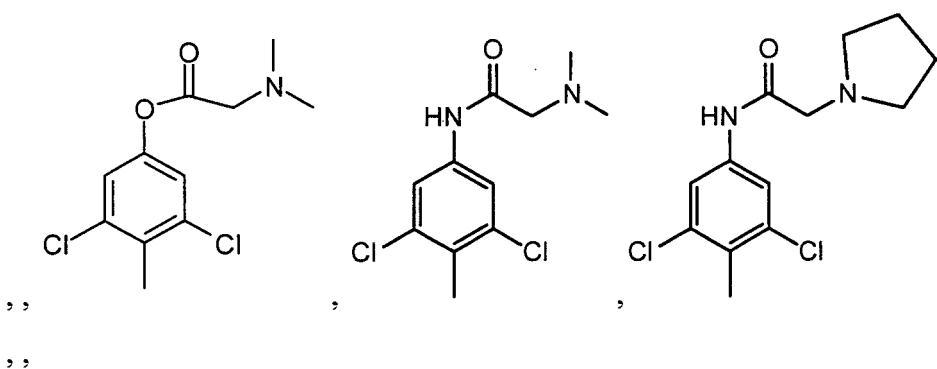
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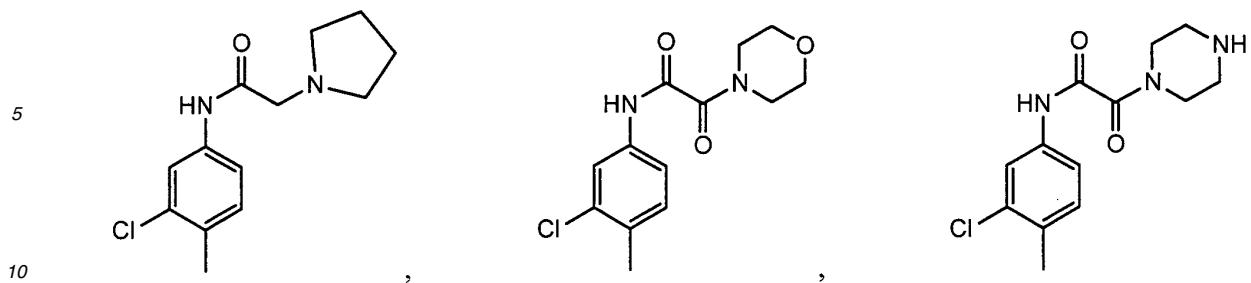


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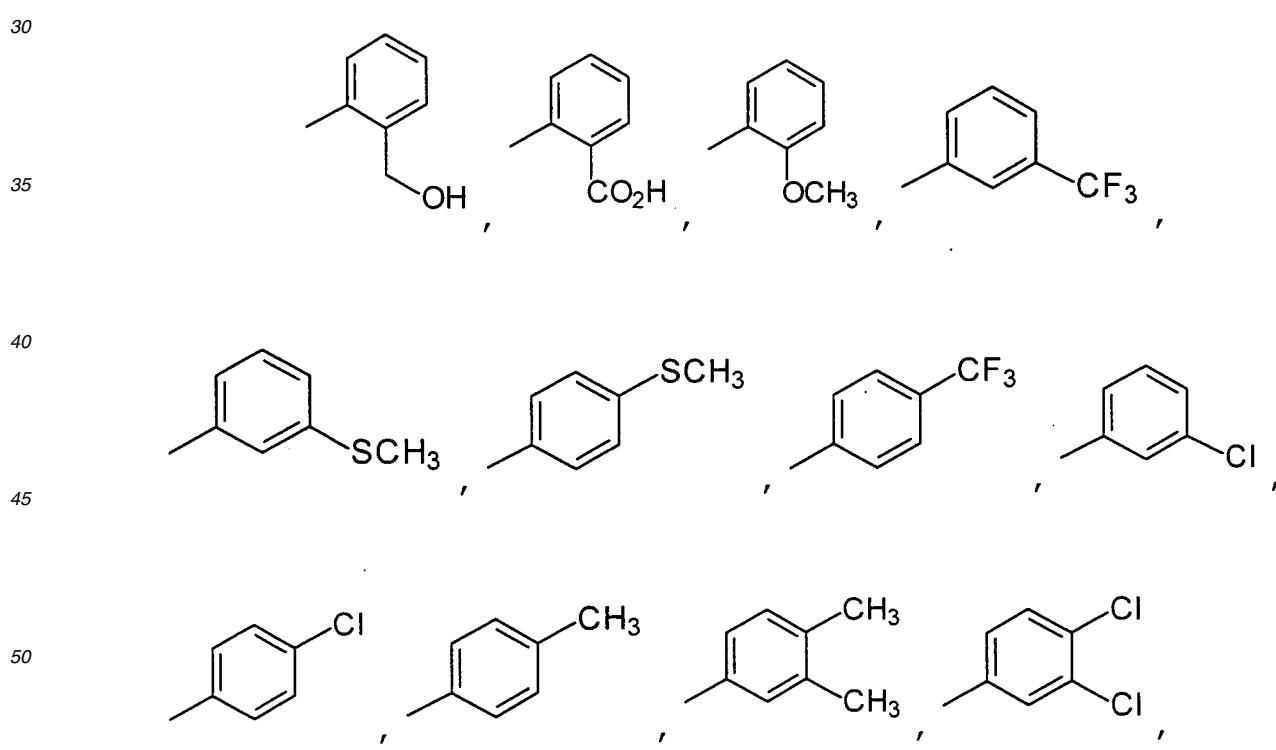


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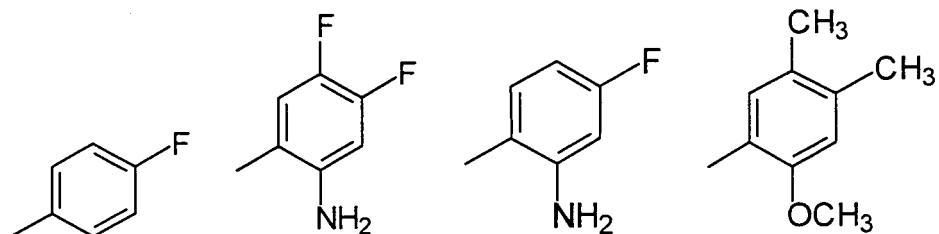
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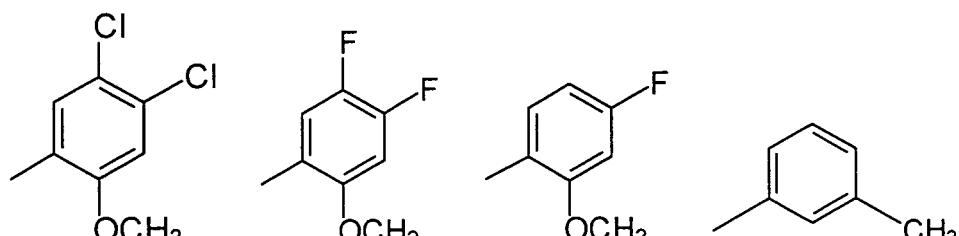


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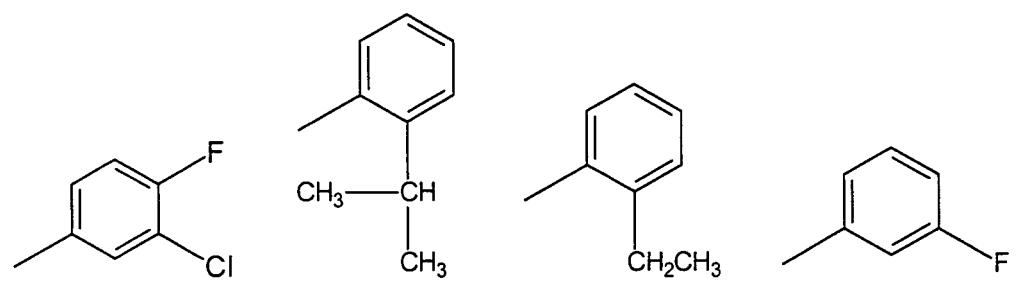


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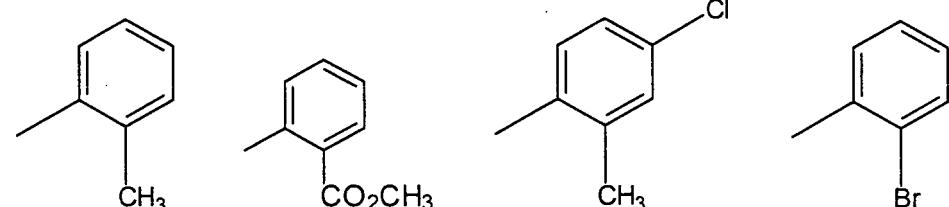
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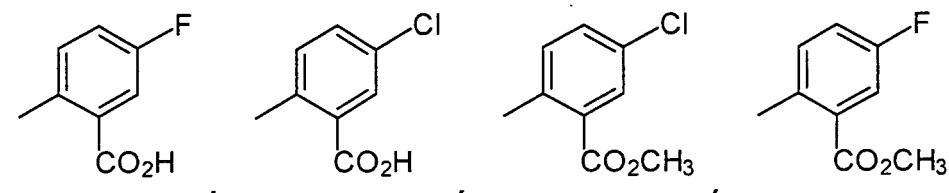
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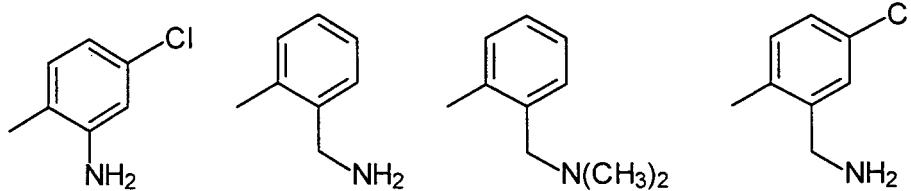


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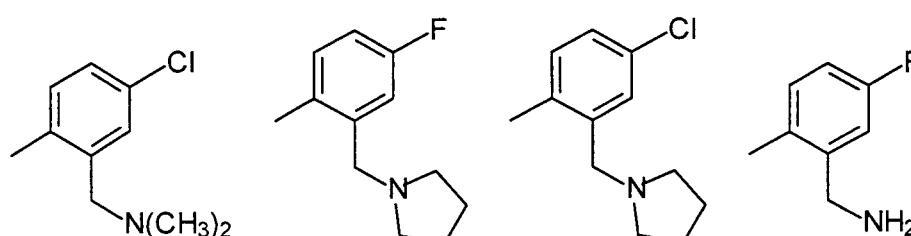


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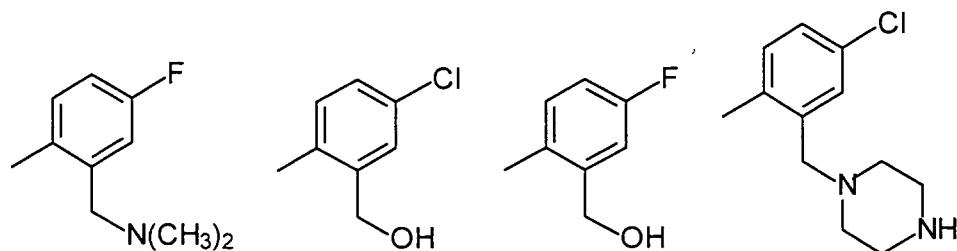
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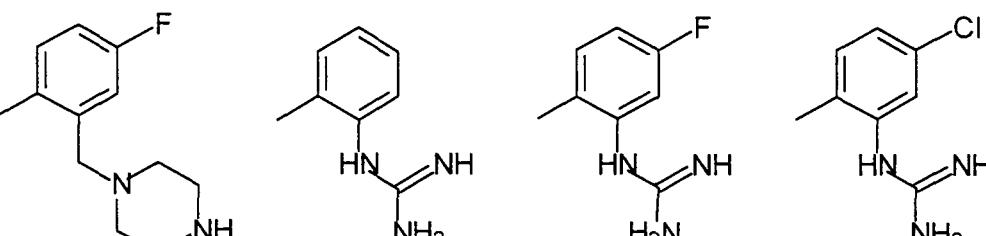
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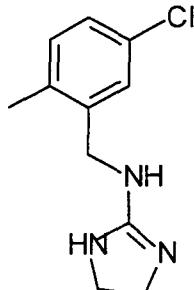
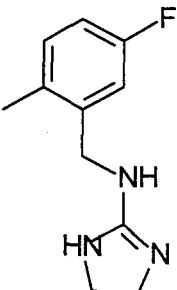
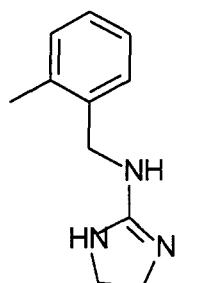
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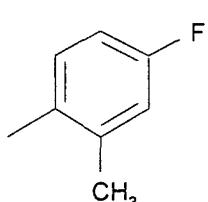
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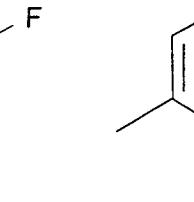
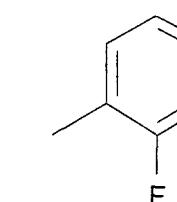
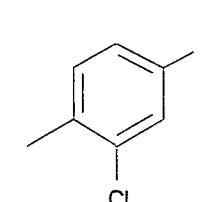
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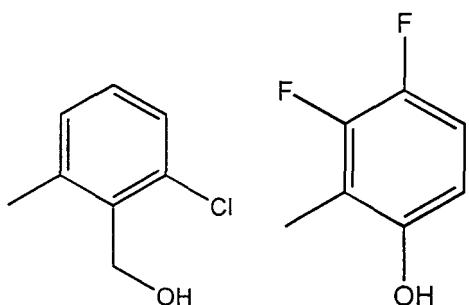
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unsubstituiertem 2-Pyridyl oder unsubstituiertem Phenyl;

R' ausgewählt ist aus Wasserstoff; (C₁-C₃)-Alkyl; (C₂-C₃)-Alkenyl oder Alkinyl; Phenyl oder Phenyl, welches substituiert ist mit 1 bis 3 Substituenten, unabhängig ausgewählt aus Halogen, Methoxy, Cyano, Nitro, Amino, Hydroxy, Methyl oder Ethyl; oder einem 5-bis 6-gliedrigen heterocyclischen Ringsystem, welches gegebenenfalls substituiert ist mit 1 bis 3 Substituenten, unabhängig ausgewählt aus Halogen, Methoxy, Cyano, Nitro, Amino, Hydroxy, Methyl oder Ethyl;

R³ ausgewählt ist aus 5- bis 8-gliedrigen aromatischen oder nicht aromatischen carbocyclischen oder heterocyclischen Ringsystemen;

W ausgewählt ist aus N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; N(R²)₂C(O)-R²; CH(OH)-R²; C(O)-N(R²)₂; C(O)-OR²; oder einem geradkettigen oder verzweigten (C₁-C₄)-Alkyl, welches gegebenenfalls substituiert ist mit N(R')₂, OR', CO₂R', CON(R')₂, R³ oder SO₂N(R²)₂; oder einem 5- bis 6-gliedrigen carbocyclischen oder heterocyclischen Ringsystem, welches gegebenenfalls substituiert ist mit N(R')₂, OR', CO₂R', CON(R')₂ oder SO₂N(R²)₂; mit der Maßgabe, dass W nicht für ein R³-substituiertes C₁-Alkyl steht;

R² ausgewählt ist aus Wasserstoff, (C₁-C₃)-Alkyl oder (C₁-C₃)-Alkenyl; jeder gegebenenfalls substituiert mit -N(R')₂, -OR', SR', -C(O)-N(R')₂, -S(O₂)-N(R')₂, -C(O)-OR';

jedes Y für C steht, wobei jedes an Y gebundene R und U unabhängig ausgewählt ist aus Wasserstoff oder Methyl;

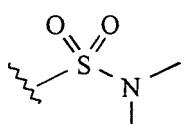
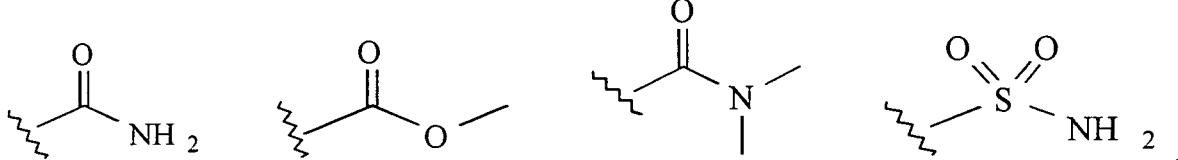
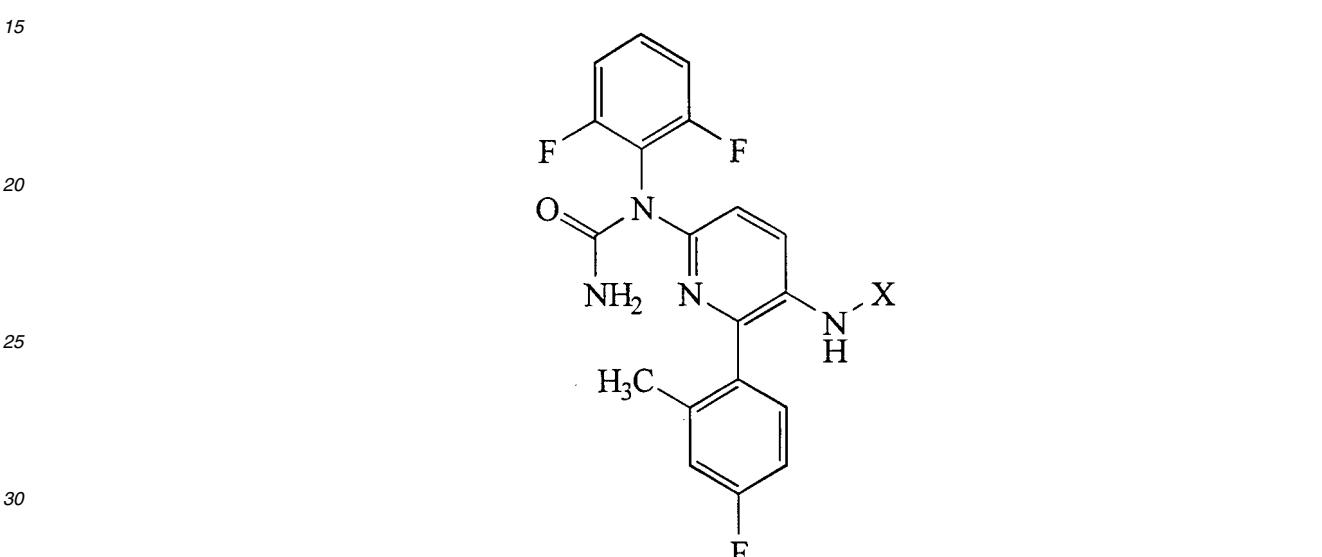
Z für CH oder N steht; und

V für -C(O)NH₂ steht.

2. Verbindung gemäß Anspruch 1, wobei Q₁ ausgewählt ist aus 2-Fluor-6-trifluormethylphenyl, 2,6-Difluorphenyl, 2,6-Dichlorphenyl, 2-Chlor-4-hydroxyphenyl, 2-Chlor-4-aminophenyl, 2,6-Dichlor-4-aminophenyl, 2,6-Dichlor-3-aminophenyl, 2,6-Dimethyl-4-hydroxyphenyl, 2-Methoxy-3,5-dichlor-4-pyridyl, 2-Chlor-4,5-methylenedioxyphenyl oder 2-Chlor-4-(N-2-morpholinoacetamido)phenyl.

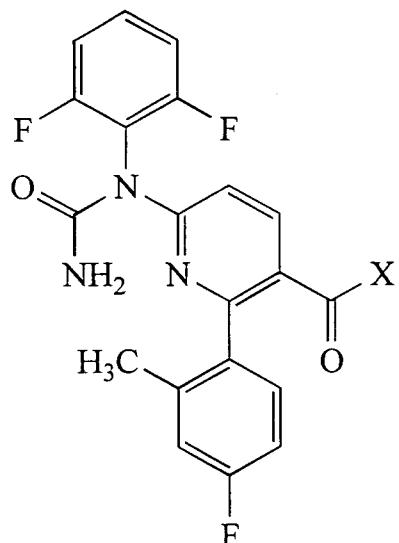
5 3. Verbindung gemäß Anspruch 1, wobei Q₂ ausgewählt ist aus Phenyl, 2-Isopropylphenyl, 3,4-Dimethylphenyl, 2-Ethylphenyl, 3-Fluorphenyl, 2-Methylphenyl, 3-Chlor-4-fluorphenyl, 3-Chlorphenyl, 2-Carbomethoxyphenyl, 2-Carboxyphenyl, 2-Methyl-4-chlorphenyl, 2-Bromphenyl, 2-Pyridyl, 2-Methylenhydroxyphenyl, 4-Fluorphenyl, 2-Methyl-4-fluorphenyl, 2-Chlor-4-fluorphenyl, 2,4-Difluorphenyl, 2-Hydroxy-4-fluorphenyl, 2-Methylenhydroxy-4-fluorphenyl oder 3-Chlor-2-methylenhydroxy.

10 4. Verbindung gemäß Anspruch 1, wobei die Verbindung



55 5. Verbindung gemäß Anspruch 1, wobei die Verbindung

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darstellt und X ausgewählt ist aus NH_2 oder $\text{N}(\text{CH}_3)_2$.

6. Verbindung gemäß Anspruch 1, wobei die Verbindung

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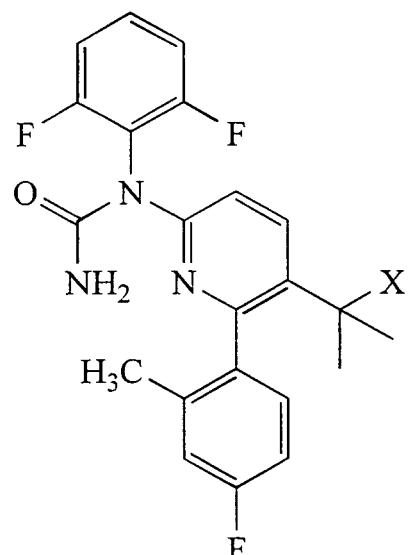
darstellt und X ausgewählt ist aus OH , NH_2 oder $\text{N}(\text{CH}_3)_2$.

7. Verbindung gemäß Anspruch 1, wobei die Verbindung

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darstellt und X ausgewählt ist aus OH, NH₂ oder N(CH₃)₂.

8. Verbindung gemäß Anspruch 1, wobei die Verbindung

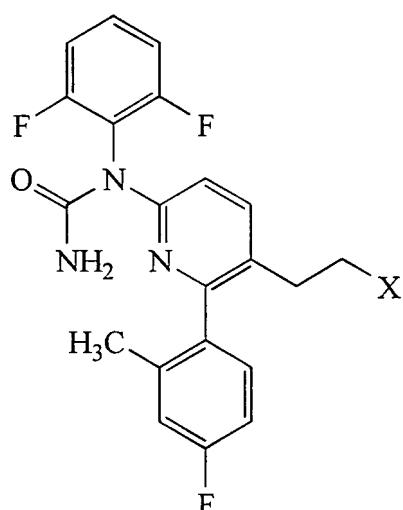
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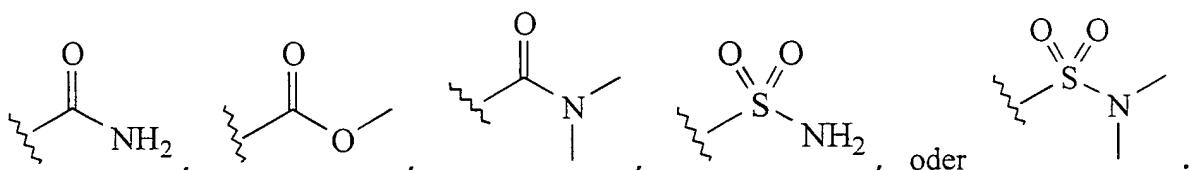
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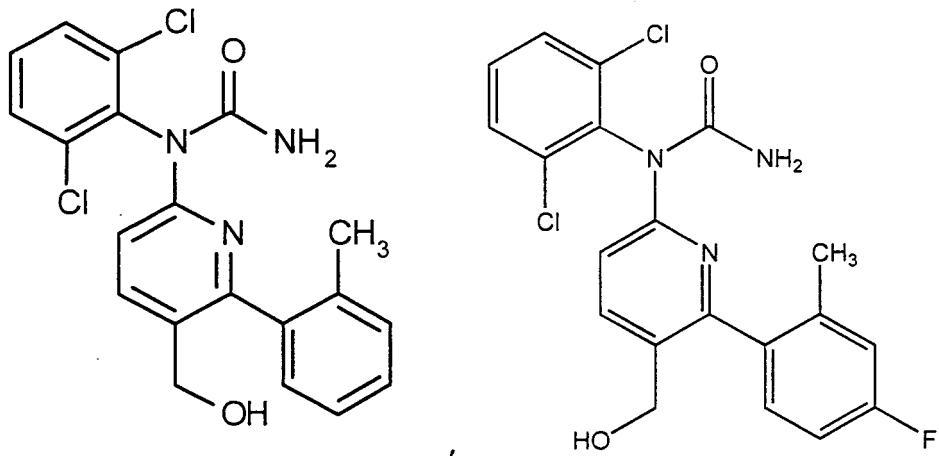
darstellt und X ausgewählt ist aus OH, NH₂, N(CH₃)₂,

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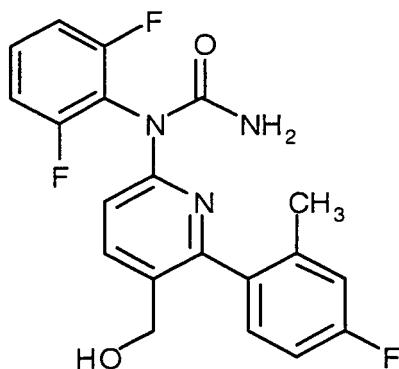
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9. Verbindung gemäß Anspruch 1, wobei die Verbindung ausgewählt ist aus einer von



oder

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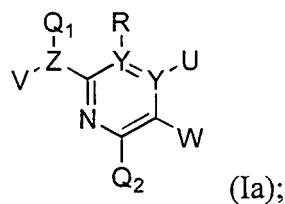
10. Arzneimittel, umfassend eine Verbindung gemäß einem der Ansprüche 1 bis 9 und einen pharmazeutisch verträglichen Träger.
11. Verwendung einer Verbindung gemäß einem der Ansprüche 1 bis 10 für die Herstellung eines Arzneimittels zum Behandeln oder Vorbeugen entzündlicher Erkrankungen, Autoimmunkrankheiten, degenerativer Knochenerkrankungen, proliferativer Erkrankungen, Infektionskrankheiten, Viruserkrankungen, neurodegenerativer Erkrankungen, Allergien, Reperfusion/Ischämie bei Schlaganfall oder myokardialer Ischämie, renaler Ischämie, Herzinfarkten, Störungen der Angiogenese, Organhypoxie, Gefäßhyperplasie, Herzhypertrophie, Thrombin-induzierter Blutplättchenaggregation oder Zuständen in Verbindung mit Prostaglandin-Endoperoxid synthase-2.
12. Verbindung gemäß einem der Ansprüche 1 bis 10 zur Verwendung beim Behandeln oder Vorbeugen entzündlicher Erkrankungen, Autoimmunkrankheiten, degenerativer Knochenerkrankungen, proliferativer Erkrankungen, Infektionskrankheiten, Viruserkrankungen, neurodegenerativer Erkrankungen, Allergien, Reperfusion/Ischämie bei Schlaganfall oder myokardialer Ischämie, renaler Ischämie, Herzinfarkten, Störungen der Angiogenese, Organhypoxie, Gefäßhyperplasie, Herzhypertrophie, Thrombin-induzierter Blutplättchenaggregation oder Zuständen in Verbindung mit Prostaglandin-Endoperoxid synthase-2.
13. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die entzündliche Erkrankung ausgewählt ist aus akuter Pankreatitis, chronischer Pankreatitis, Asthma, Allergien oder Schocklunge (ARDS).
14. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die Autoimmunkrankheit ausgewählt ist aus Glomerulonephritis, rheumatoider Arthritis, systemischem Lupus erythematoses, Sklerodermie, chronischer Thyroiditis, Morbus Basedow, Autoimmungastritis, Diabetes, autoimmunhämolytischer Anämie, Autoimmunneutro-

penie, Thrombozytopenie, atopischer Dermatitis, chronisch-aktiver Hepatitis, Myasthenia gravis, multipler Sklerose, Reizdarm, Colitis ulcerosa, Morbus Crohn, Schuppenflechte oder Transplantat-Wirt-Reaktion.

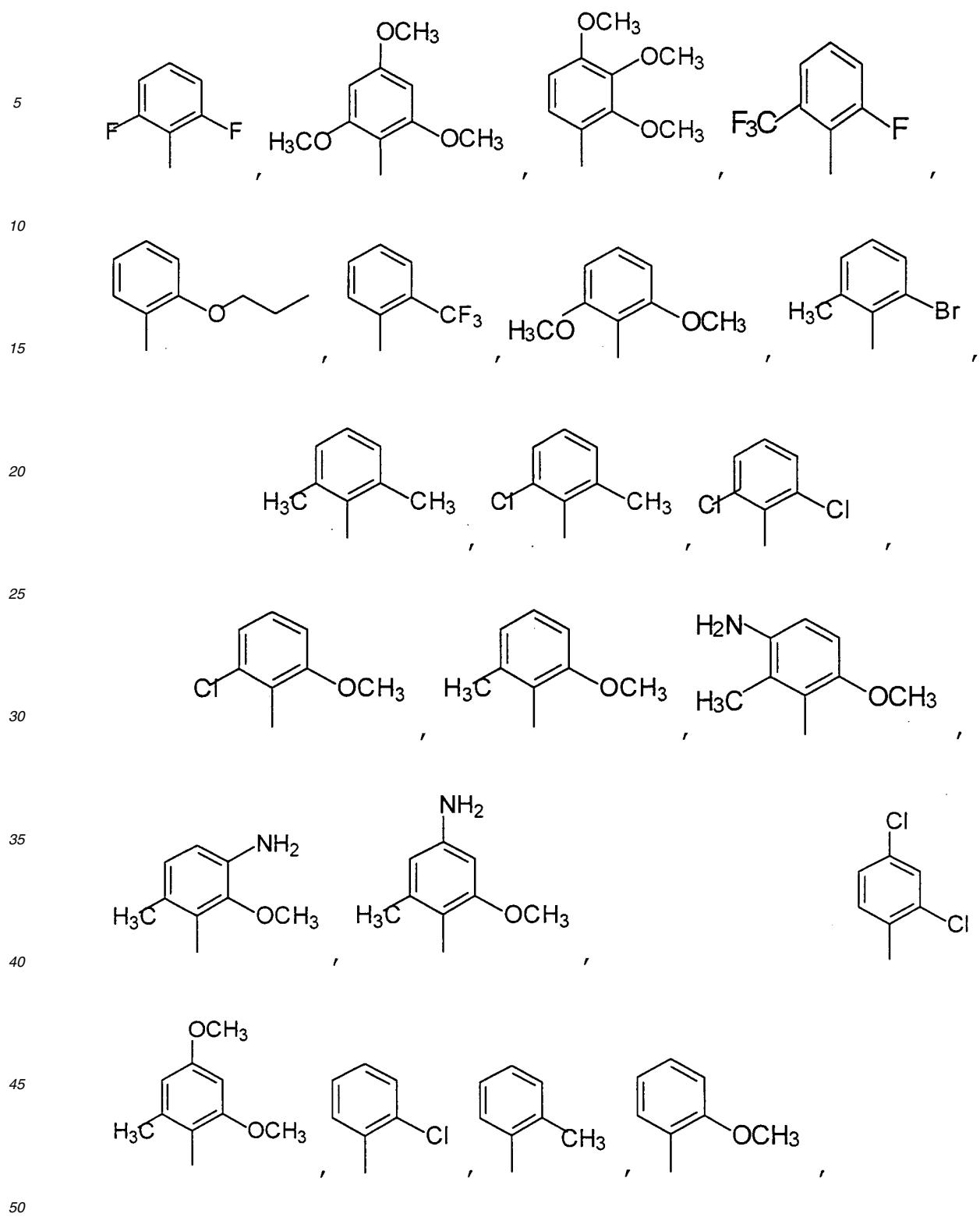
15. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die degenerative Knochenerkrankung ausgewählt ist aus Arthrose, Osteoporose oder einer mit multiplen Myelom in Beziehung stehenden Knochenerkrankung.
16. Verbindung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die proliferative Erkrankung ausgewählt ist aus akuter myelogener Leukämie, chronischer myelogener Leukämie, metastatischem Melanom, Kaposi-Sarkom oder multiplen Myelom.
17. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die Infektionskrankheit ausgewählt ist aus Sepsis, septischem Schock oder Shigellose.
18. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die Viruserkrankung ausgewählt ist aus akuter Hepatitisinfektion, HIV-Infektion oder CMV-Retinitis.
19. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die neurodegenerative Erkrankung ausgewählt ist aus Alzheimer-Krankheit, Parkinson-Krankheit, zerebraler Ischämie oder durch eine traumatische Verletzung verursachten neurodegenerativen Erkrankung.
20. Verwendung gemäß Anspruch 11 zum Behandeln oder Vorbeugen oder Verbindung gemäß Anspruch 12, zur Verwendung in der Behandlung oder Vorbeugung von Ischämie/Reperfusions bei Schlaganfall oder myokardialer Ischämie, renaler Ischämie, Herzinfarkten, Organhypoxie oder Thrombin-induzierter Blutplättchenaggregation.
21. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die mit Prostaglandin-Endoperoxid-synthase-2 in Verbindung stehenden Zustände ausgewählt sind aus Ödem, Fieber, Analgesie oder Schmerz.
22. Verwendung oder Verbindung gemäß Anspruch 21, wobei der Schmerz ausgewählt ist aus neuromuskulösem Schmerz, Kopfschmerz, Krebs-bedingtem Schmerz, Zahnschmerz oder Arthritisschmerz.
23. Verwendung gemäß Anspruch 11 oder Verbindung gemäß Anspruch 12, wobei die Störung der Angiogenese ausgewählt ist aus soliden Tumoren, Neovaskularisation am Auge oder infantilen Hämangiomen.

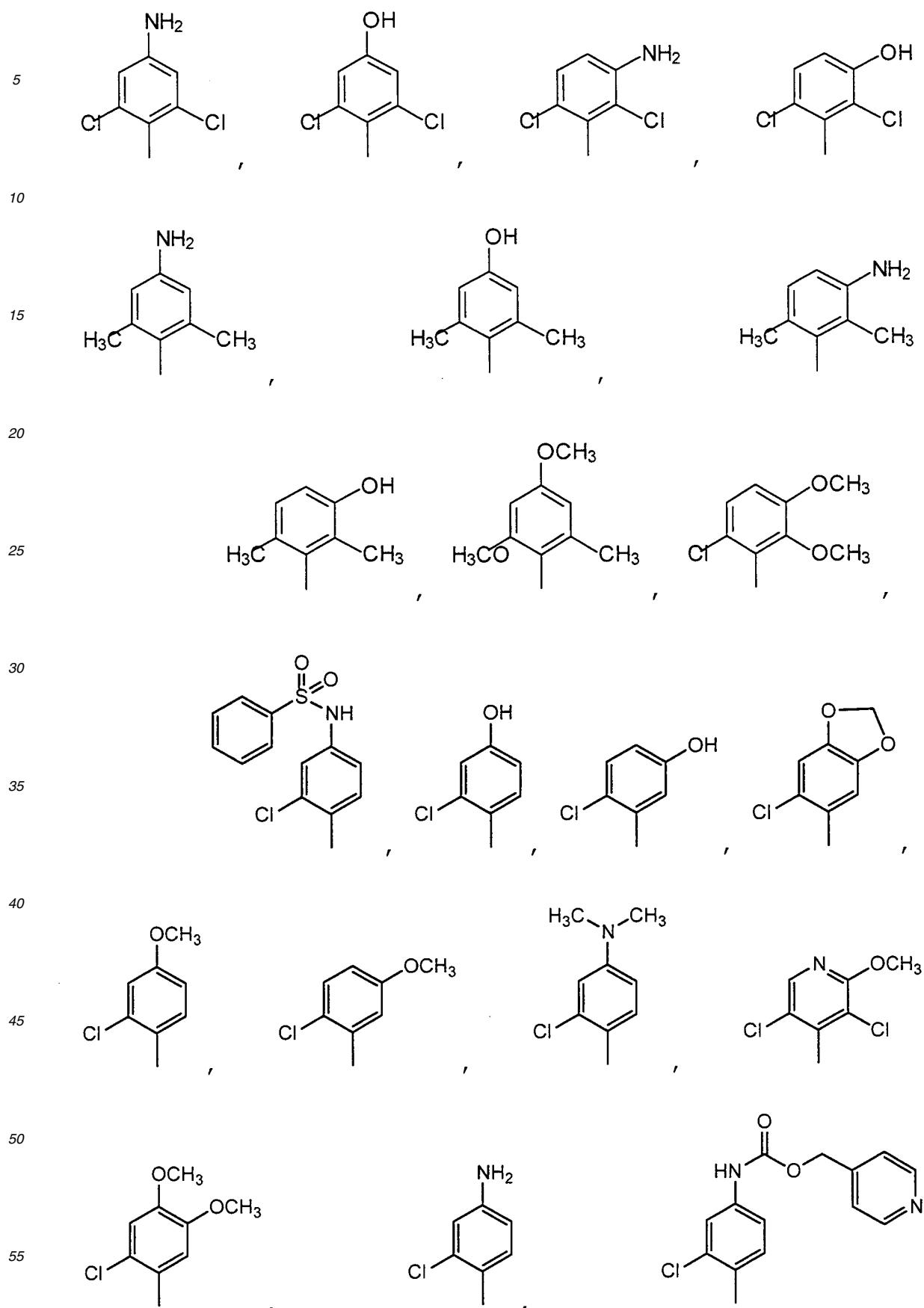
Revendications

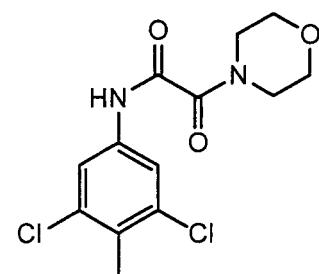
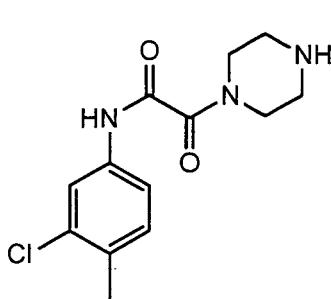
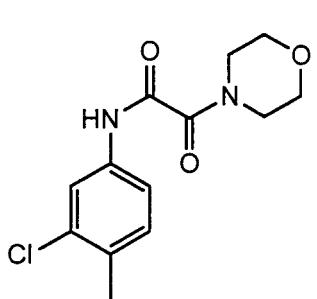
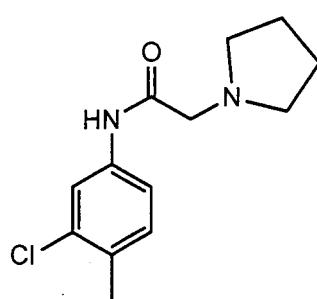
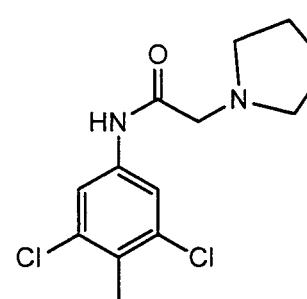
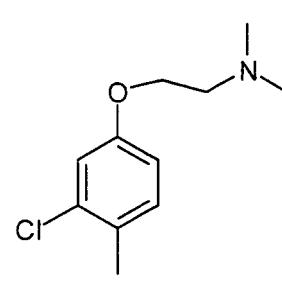
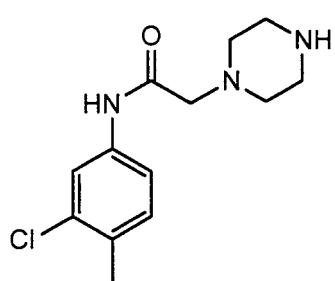
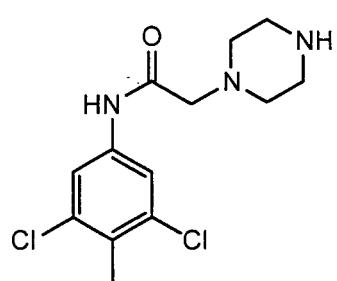
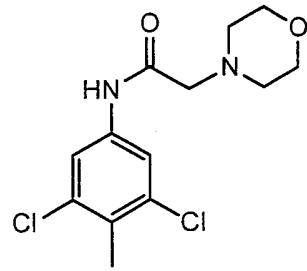
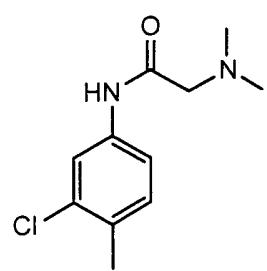
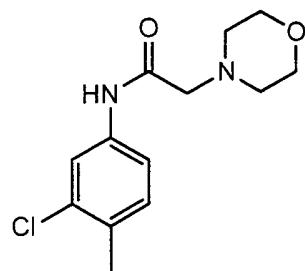
1 Composé de la formule:



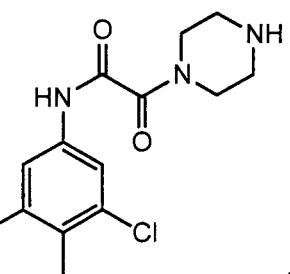
où Q_1 est sélectionné parmi:

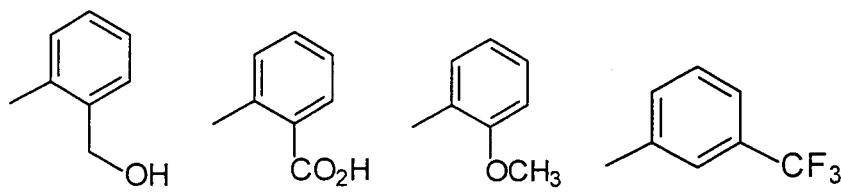




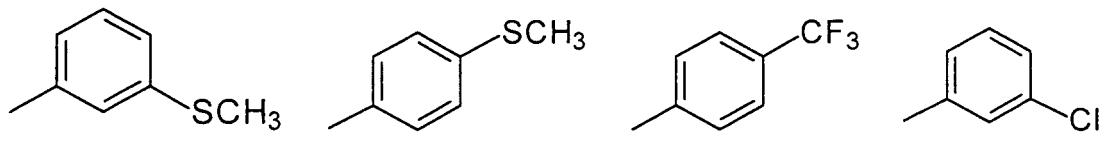


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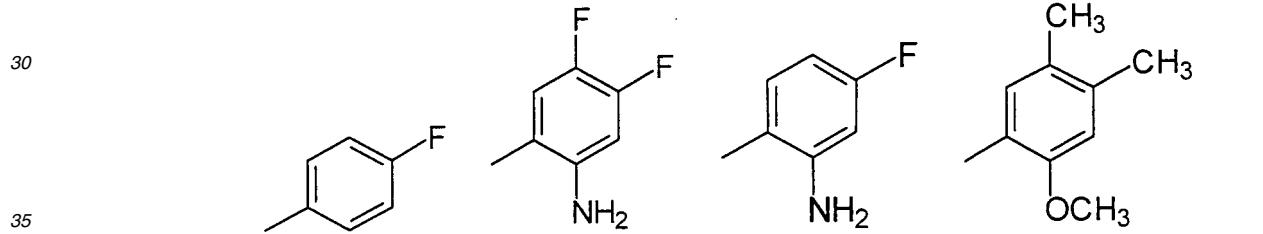
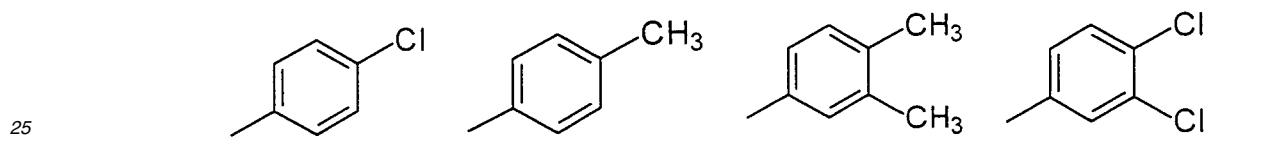


Q₂ est sélectionné parmi:

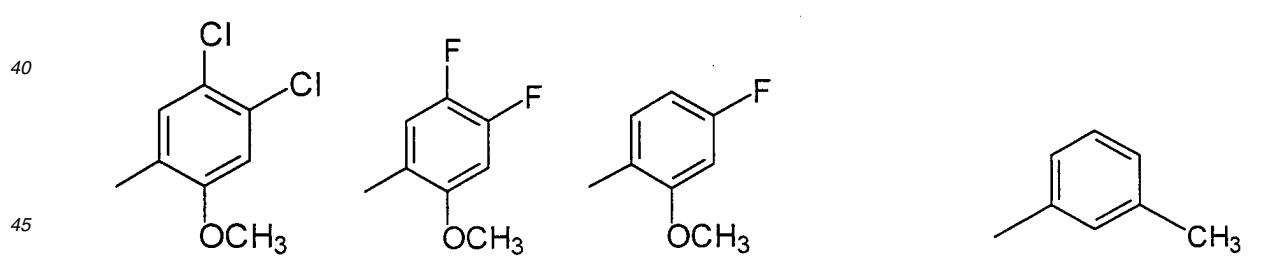
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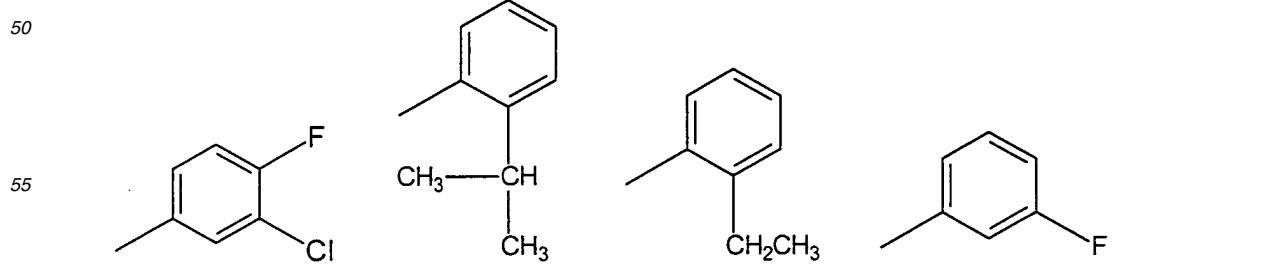
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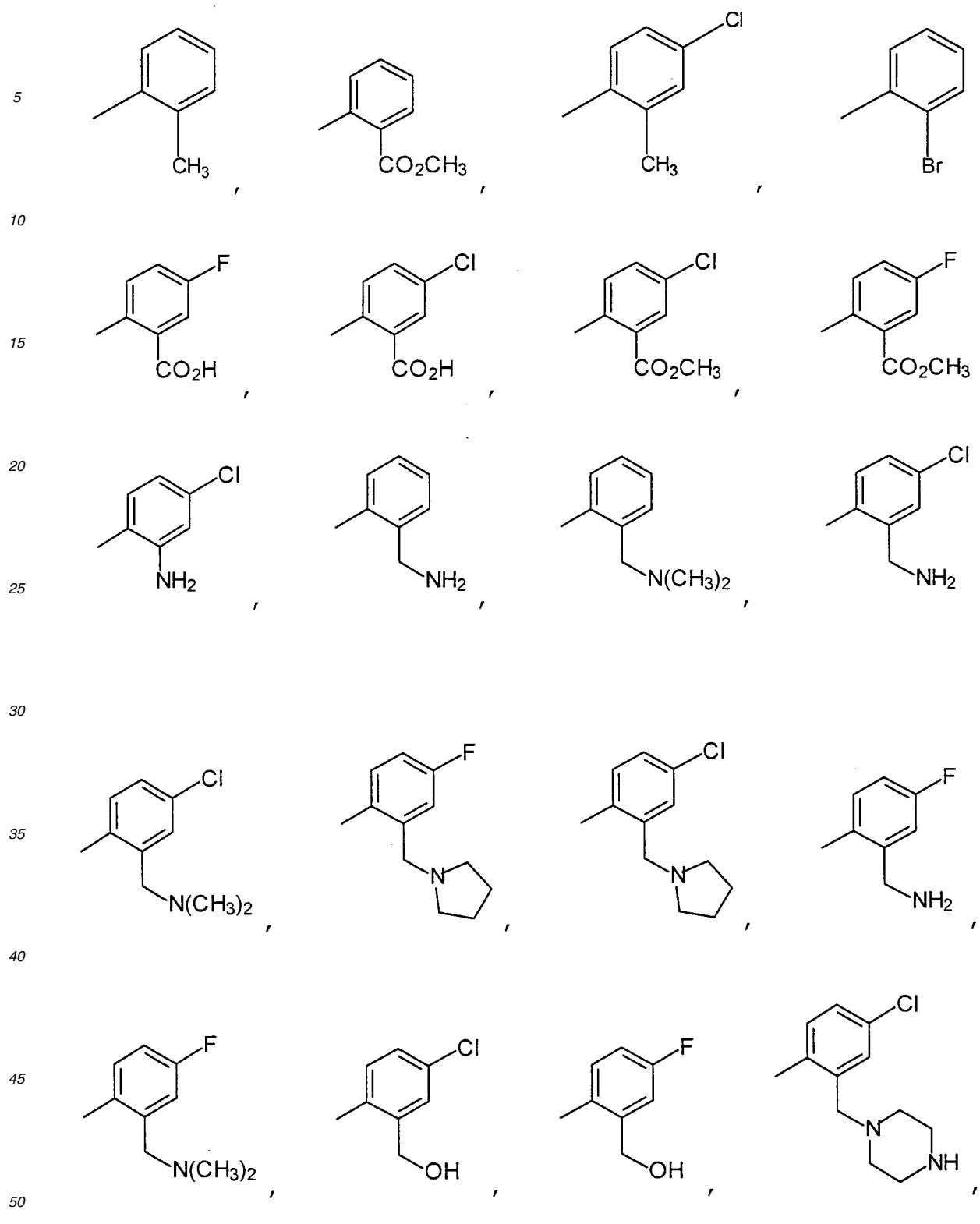
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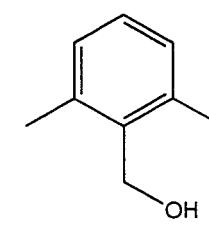
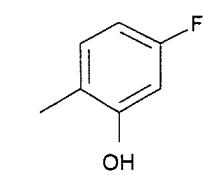
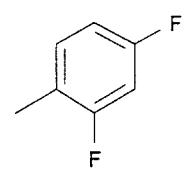
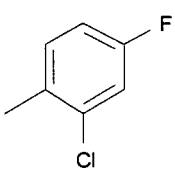
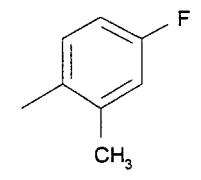
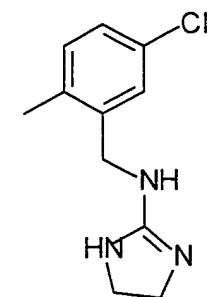
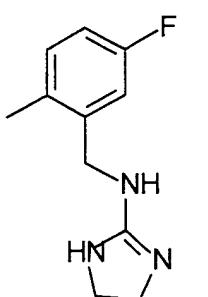
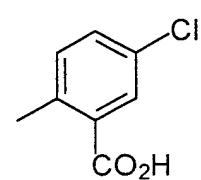
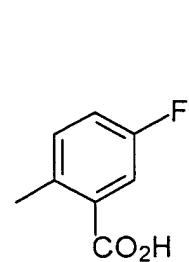
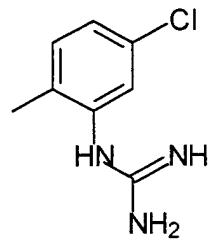
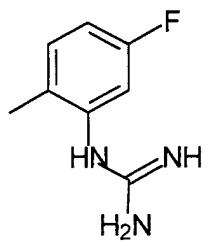
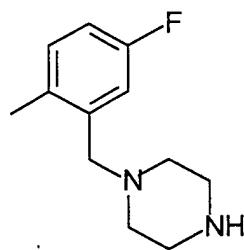


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2-pyridyle non substitué ou phényle non substitué;

R' est sélectionné parmi l'hydrogène; (C₁-C₃)-alkyle; (C₂-C₃)-alkényle or alkynyle; phényle or phényle substitué

avec 1 to 3 substituants indépendamment sélectionnés parmi halo, methoxy, cyano, nitro, amino, hydroxy, méthyle or éthyle; or a système cyclique hétérocyclique à 5-6 chaînons optionnellement substitué avec 1 to 3 substituants sélectionnés indépendamment parmi halo, methoxy, cyano, nitro, amino, hydroxy, méthyle or éthyle;

5 R³ est sélectionné parmi des systèmes cycliques, carbocycliques ou hétérocycliques aromatiques ou non aromatiques à 5-8 chaînons;

W est sélectionné parmi N(R²)SO₂-N(R²)₂; N(R²)SO₂-N(R²)(R³); N(R²)C(O)-OR²; N(R²)C(O)-N(R²)₂; N(R²)C(O)-N(R²)(R³); N(R²)C(O)-R²; N(R²)₂; C(O)-R²; CH(OH)-R²; C(O)-N(R²)₂; C(O)-OR²; ou (C₁-C₄) alkyle linéaire ou branché optionnellement substitué avec N(R²)₂, OR², CO₂R², CON(R²)₂, R³, ou SO₂N(R²)₂; ou un système cyclique, carbocyclique ou hétérocyclique à 5-6 chaînons optionnellement substitué avec N(R²)₂, OR², CO₂R², CON(R²)₂, ou SO₂N(R²)₂; à condition que W ne soit pas un C₁ alkyle substitué par R³;

10 R² est sélectionné parmi l'hydrogène, (C₁-C₃)-alkyle, ou (C₁-C₃)-alkényle; chacun substitué optionnellement avec -N(R¹)₂, -OR¹, SR¹, -C(O)-N(R¹)₂, -S(O₂)-N(R¹)₂, -C(O)-OR¹;

15 chaque Y est C, où chaque R et U attachés à Y est indépendamment sélectionné parmi l'hydrogène ou le méthyle;

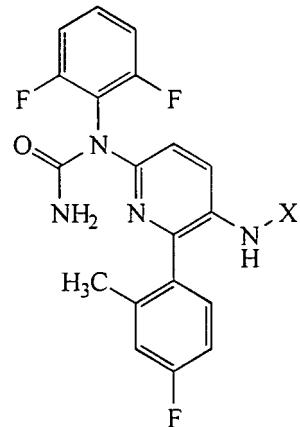
Z est CH ou N; and

V est -C(O)NH₂.

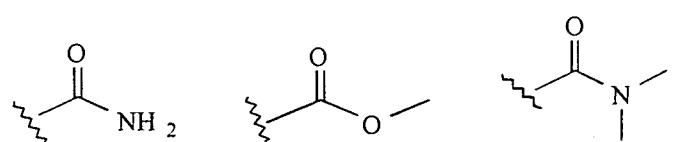
2. Composé selon la revendication 1, où Q₁ est sélectionné parmi 2-fluoro-6-trifluorométhylphényle, 2,6-difluorophényle, 2,6-dichlorophényle, 2-chloro-4-hydroxyphényle, 2-chloro-4-aminophényle, 2,6-dichloro-4-aminophényle, 2,6-dichloro-3-aminophényle, 2,6-diméthyl-4-hydroxyphényle, 2-méthoxy-3,5-dichloro-4-pyridyle, 2-chloro-4,5 méthylénedioxy phényle, ou 2-chloro-4-(N-2-morpholino-acétamido)phényle.

3. Composé selon la revendication 1, où Q₂ est sélectionné parmi phényle, 2-isopropylphényle, 3,4-diméthylphényle, 2-éthylphényle, 3-fluorophényle, 2-méthylphényle, 3-chloro-4-fluorophényle, 3-chlorophényle, 2-carbométhoxyphényle, 2-carboxyphényle, 2-méthyl-4-chlorophényle, 2-bromophényle, 2-pyridyle, 2-méthylènehydroxyphényle, 4-fluorophényle, 2-méthyl-4-fluorophényle, 2-chloro-4-fluorophényle, 2,4-difluorophényle, 2-hydroxy-4-fluorophényle, 2-méthylènehydroxy-4-fluorophényle, or 3-chloro-2-méthylènehydroxy.

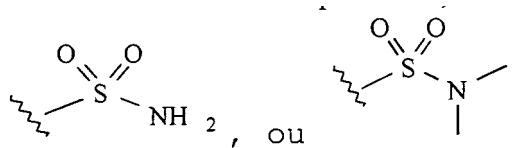
4. Composé selon la revendication 1, où le composé est



et X est sélectionné parmi H,



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5. Composé selon la revendication 1, où le composé est

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et X est sélectionné parmi NH_2 ou $\text{N}(\text{CH}_3)_2$.

6. Composé selon la revendication 1, où le composé est

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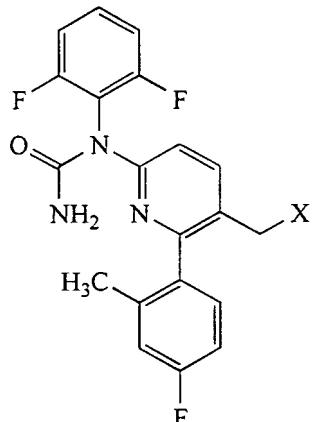
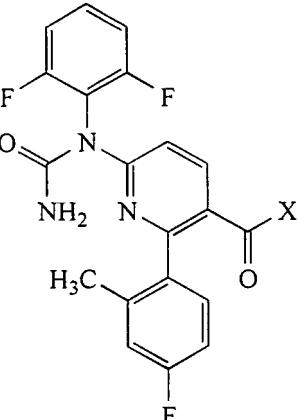
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et X est sélectionné parmi OH , NH_2 , ou $\text{N}(\text{CH}_3)_2$.

7. Composé selon la revendication 1, où le composé est

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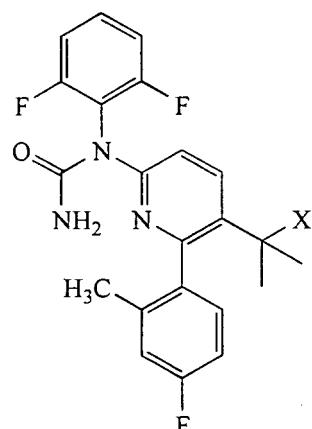
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et X est sélectionné parmi OH, NH₂, ou N(CH₃)₂.

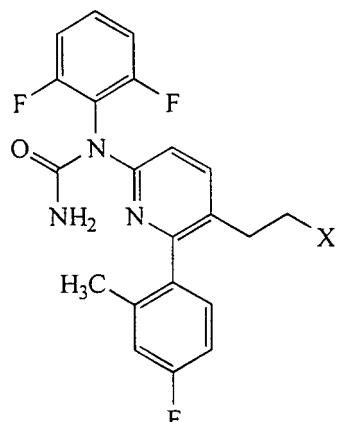
8. Composé selon la revendication 1, où le composé est

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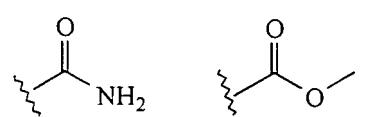
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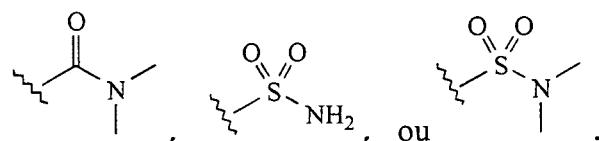
et X est sélectionné parmi OH, NH₂, N(CH₃)₂,

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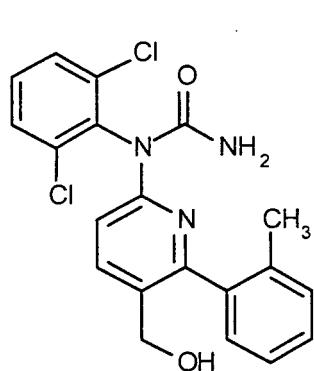


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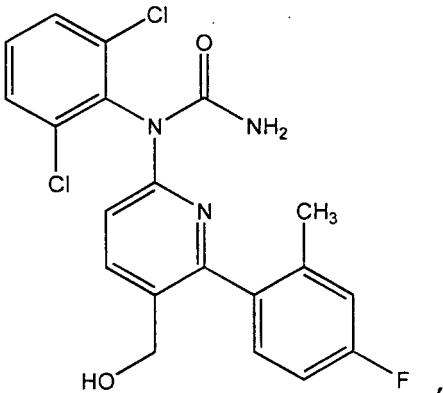


55 9. Composé selon la revendication 1, où ledit composé est sélectionné parmi l'une quelconque de

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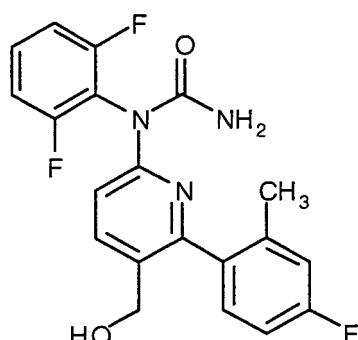
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ou

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10. Composition pharmaceutique comprenant un composé selon l'une quelconque des revendications 1 à 9, et un support pharmaceutiquement acceptable.

35 11. Utilisation d'un composé selon l'une quelconque des revendications 1 à 10 pour la préparation d'une composition pharmaceutique pour traiter ou empêcher des infections inflammatoires, des maladies auto-immunes, des affections destructrices d'os, des affections proliférantes, des maladies infectieuses, des maladies virales, des maladies neurodégénératrices, des allergies, reperfusion/ischémie lors d'une attaque d'apoplexie ou ischémie du myocarde, ischémie rénale, crises cardiaques, troubles angiogéniques, hypoxie d'organe, hyperplasie vasculaire, hypertrophie cardiaque, agrégation de plaquettes induite par thrombine ou conditions associées à la prostaglandine endopéroxyde synthase-2.

45 12. Composé selon l'une quelconque des revendications 1 à 10 utilisé pour le traitement ou pour empêcher des infections inflammatoires, des maladies auto-immunes, des affections destructrices d'os, des affections proliférantes, des maladies infectieuses, des maladies virales, des maladies neurodégénératrices, des allergies, une reperfusion/ischémie lors d'une attaque d'apoplexie ou ischémie du myocarde, ischémie rénale, crises cardiaques, troubles angiogéniques, hypoxie d'organe, hyperplasie vasculaire, hypertrophie cardiaque, agrégation de plaquettes induite par thrombine ou conditions associées à la prostaglandine endopéroxyde synthase-2.

50 13. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où la maladie inflammatoire est sélectionnée parmi la pancréatite aiguë, pancréatite chronique, asthme, allergie ou le syndrome de détresse respiratoire de l'adulte.

55 14. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où la maladie auto-immune est sélectionnée parmi la glomérulonéphrite, l'arthrite rhumatoïde, lupus érythémateux systémique, sclérodermie, thyroïdite chronique, maladie de Basedow, gastrite auto-immune, diabète, anémie hémolytique auto-immune, neutropénie auto-immune, thrombopénie, dermatite atopique, hépatite active chronique, myasthénie gravis, sclérose en

plaques, affection abdominale inflammatoire, recto-colite hémorragique, maladie de Crohn, psoriasis, ou affection de greffe versus hôte.

5 15. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où l'affection destructrice d'os est sélectionnée parmi l'ostéoarthrite, l'ostéoporose ou l'affection d'os liée à des myélomes multiples.

10 16. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où l'affection proliférante est sélectionnée parmi la leucémie myéloïde aiguë, leucémie myéloïde chronique, mélanome métastatique, sarcome de Kaposi, ou myélome multiple.

15 17. Utilisation selon la revendication 11 ou le composé selon la revendication 12, ou la maladie infectieuse est sélectionnée parmi la sepsie, choc infectieux, ou shigellose.

15 18. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où la maladie virale est sélectionnée parmi l'infection d'hépatite aiguë, infection VIH ou rétinite à cytomégalovirus.

20 19. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où la maladie neurodégénératrice est sélectionnée parmi la maladie d'Alzheimer, la maladie de Parkinson, l'ischémie cérébrale ou l'affection neurodégénératrice provoquée par une blessure traumatique.

25 20. Utilisation selon la revendication 11, pour traiter ou empêcher, ou le composé selon la revendication 12, utilisé pour traiter ou empêcher une ischémie/reperfusion lors d'une attaque d'apoplexie ou d'une ischémie du myocarde, ischémie rénale, crises cardiaques, hypoxie d'organe ou agrégation de plaquettes induite par thrombine.

25 21. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où la condition associée à la prostaglandine endopéroxyde synthase-2 est sélectionnée parmi l'oedème, la fièvre, l'analgesie ou la douleur.

30 22. Utilisation ou composé selon la revendication 21, où ladite douleur est sélectionnée parmi la douleur neuromusculaire, le mal de tête, la douleur du cancer, la douleur dentaire ou la douleur d'arthrite.

30 23. Utilisation selon la revendication 11 ou le composé selon la revendication 12, où l'affection angiogénique est sélectionnée parmi des tumeurs solides, la néovascularisation oculaire, ou l'hémangiome infantile.

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REFERENCES CITED IN THE DESCRIPTION

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